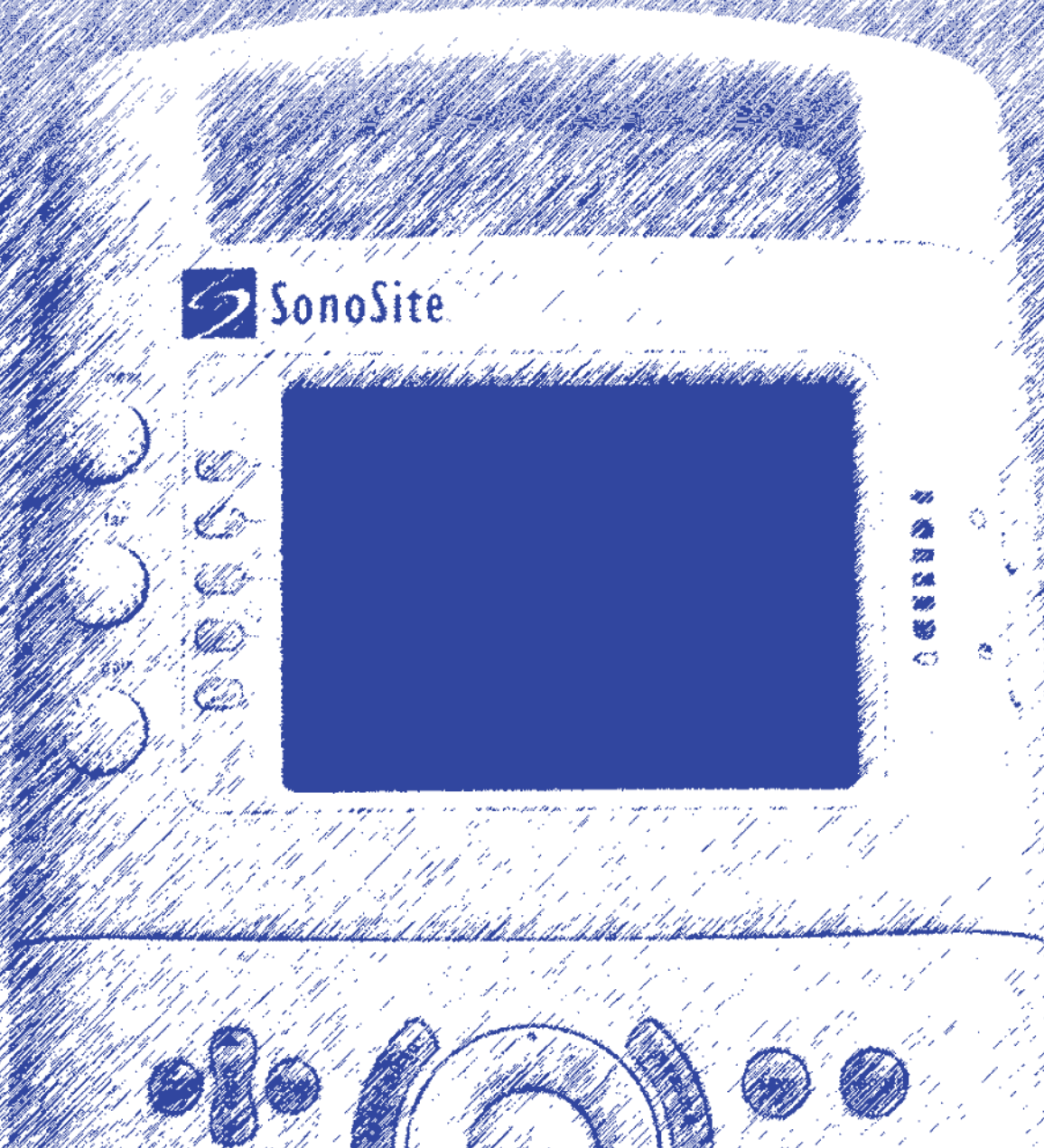


# SonoSite

## Ultrasound System User Guide



# SonoSite

Ultrasound System User Guide

11/2002

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# .....Chapter 1: Read This First

Please read this information before using the ultrasound system. It applies to the ultrasound system, transducers, accessories, and peripherals.

## About the User Guide

This user guide is a reference for your work with the SonoSite ultrasound system. It is designed for a reader familiar with ultrasound techniques; it does not provide training in sonography or clinical practices. Before using the system, you must have ultrasound training.

The user guide covers the preparation, use and maintenance of the ultrasound system, transducers, and accessories. Refer to the manufacturers' instructions for specific information about peripherals.

The user guide includes a table of contents and an index to help you find the information that you need. A glossary contains definitions of terms and symbols used on the system.

The user guide is divided into the following chapters:

[Chapter 1, “Read This First”](#) contains general information about the user guide and the system. Customer assistance information is also included here.

[Chapter 2, “Safety”](#) contains information required by various regulatory agencies, including information about ALARA (as low as reasonably achievable), the output display standard, acoustic power and intensity tables, and other safety information.

[Chapter 3, “Preparing the System”](#) contains information about preparing the system for use, including information about connecting transducers, system power, AC power, checking and charging the battery, system setup, upgrading the system software, obtaining a license key and installing a license key.

[Chapter 4, “Imaging”](#) contains information about entering patient data, acoustic coupling gel, transducer covers, imaging, annotating, saving and reviewing images, printing, recording, and biopsy guidelines.

[Chapter 5, “Measurements and Calculations”](#) contains information on how to use the SonoSite system for performing measurements and calculations in the different imaging modes.

[Chapter 6, “Troubleshooting and Maintenance”](#) contains information to help you correct problems with system operation and proper care of the system, transducers, and accessories.

[Chapter 7, “Specifications”](#) contains system and accessory specifications and agency approvals. Specifications of peripherals are in the manufacturers’ instructions.

[Chapter 8, “References”](#) contains information about measurement accuracy and the sources from which the system measurements and calculations are derived.

[Chapter 9, “Glossary”](#) contains definitions of system symbols and terms.

## Conventions Used in This User Guide

These conventions are used in this user guide:

- Warnings and cautions are identified with the arrow symbol.
- Operating instructions are introduced with a statement in **bold-face** type that ends with a colon. For example: **To read this user guide:**
- When the steps in the operating instructions must be performed in a specific order, the steps are numbered.
- Bulleted lists present information in list format, but they do not imply a sequence.
- Screen display text is shown in Arial 10 pt. For example: Successful upgrade.
- The left side of the system is to your left as you face the system. The system handle is at the top of the system, the battery compartment is at the bottom of the system.

## Symbols and Terms Used in This User Guide

Symbols and terms used on the system, are explained in [Chapter 2, “Safety”](#) and/or [Chapter 9, “Glossary”](#).

## Upgrades and User Guide Updates

SonoSite may offer software upgrades, new features, and may improve system performance. User guide updates, explaining the effects of upgrades and new features on system performance, will accompany the upgrades.

## Customer Assistance and Comments

Questions and comments are encouraged. SonoSite is interested in your ideas about the system and the user guide. Please call SonoSite at **1-888-482-9449**. If you are outside the USA, call the nearest SonoSite representative. You can also send electronic mail (e-mail) to SonoSite at the following address:

**comments@sonosite.com**

## About the System

The SonoSite system has various configurations and features. All are described in this manual but not every option may apply to your system. System features are dependent on your system configuration, transducer and exam type.

The SonoSite system is a portable, software-controlled, ultrasound system. It has an all-digital architecture. It is used to acquire and display high-resolution, real-time, 2D, color power Doppler (CPD), directional color power Doppler (DCPD), Tissue Harmonic Imaging (THI), M-mode, pulsed wave (PW) Doppler, and continuous wave (CW) Doppler ultrasound images. The system has electrocardiography (ECG), cine review, image zoom, labeling, biopsy, measurements and calculations, serial connection for image transfer, image storage and review, printing and recording with the capability of archiving Doppler with audio output to a videotape. The system setup also has a selection to support optical character recognition (OCR) of the English character set for time, date, patient name, and patient identification. The OCR screen characters are optimized for use with the ALI NewPORT DICOM image capture station peripheral available from ALI. For more information about the ALI NewPORT 2.1, refer to the *ALI NewPORT 2.1 Image Capture Station User's Guide*.

Currently, the system supports the following broadband transducers:

- C60/5-2 MHz 60-mm curved array
- C15/4-2 MHz 15-mm microcurved array
- C11/7-4 MHz 11-mm microcurved array
- ICT/7-4 MHz 11-mm intracavitary array
- L38/10-5 MHz 38-mm linear array
- HST/10-5 MHz 25-mm linear array

System accessories include a SiteStand<sup>®</sup> mobile docking station, flat panel display, VCR bracket for SiteStand, SiteCharge<sup>®</sup> dual battery charger, a power adapter, a battery, ECG cable, video and printer cables, audio cable, SiteLink image manager software, Basic Stand, CRT Stand, ScanPack quick access carrier, Grab and Go Carrying Case, and SitePack<sup>®</sup> protective carry pack.

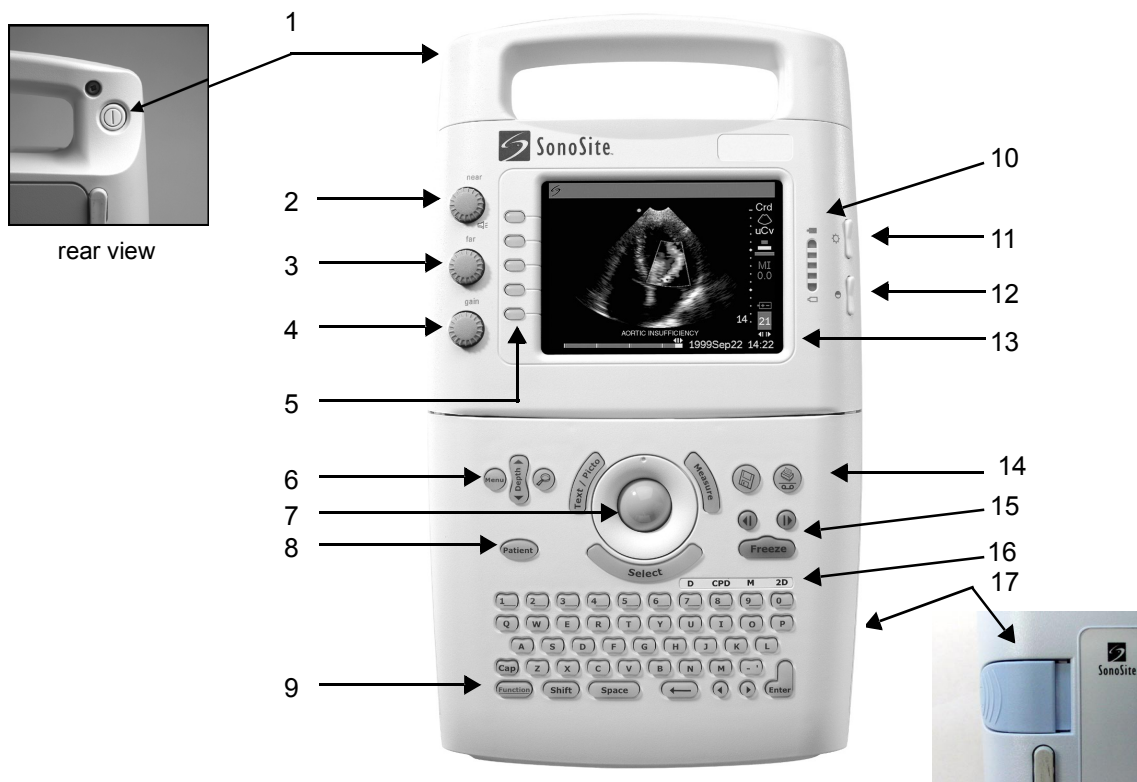
System peripherals include medical grade (conforming to the requirements of EN60601-1) and non-medical (commercial) grade products. System medical grade peripherals include an external color monitor, video printers, and VCR. System non-medical grade peripherals include a digital video recorder, a battery charger, a lithium-ion battery, printer, and a handheld monitor. Use of peripherals is covered in the manufacturers' instructions, which accompany each peripheral. System setup instructions for the use of peripherals are covered in [Chapter 3, "Using System Setup" on page 51](#).

## **Conventions Used on the System**

The software that runs the system uses graphic display elements similar to those used in many personal computers. System symbols and terms are explained in the ["Glossary."](#)

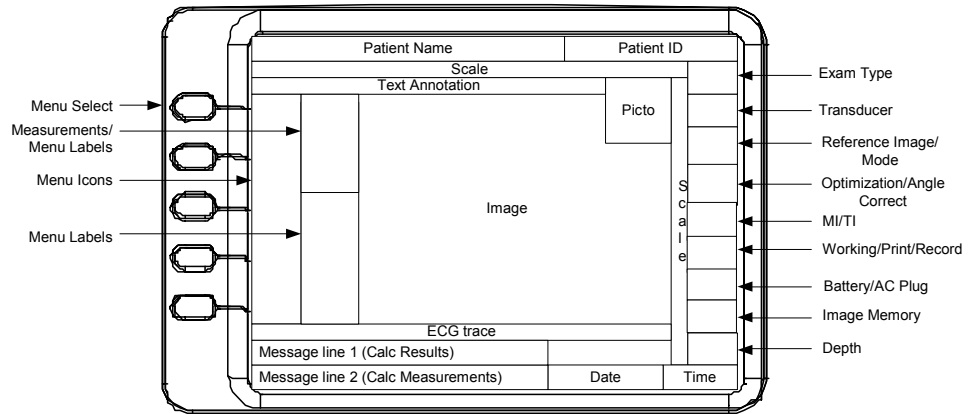
If a menu item or icon is selectable, then the menu item or icon is light gray. If a menu item or icon is not selectable, then the menu item or icon is dark gray. The active menu item or icon is green.

The following figure and table describe the system controls.



Number	Feature	Number	Feature
1	power switch, located on the rear of the system handle	10	battery charge indicators
2	near, affects gain of shallow echoes	11	LCD (liquid crystal display) brightness control
3	far, affects gain of deeper echoes	12	LCD contrast control
4	gain, affects overall gain	13	LCD
5	menu select controls	14	Print/VCR or Print key
6	Menu, Depth, and Zoom	15	Cine Arrow keys and Freeze key
7	trackball	16	mode controls
8	Patient	17	battery release
9	Function key		

The following figure shows the display and the layout of the screen:



## About the System Software

Your SonoSite system contains software that controls its operation. From time to time, SonoSite may provide new software for use with your system. This software is provided using a software update module or a transducer. This software is either required or optional. A single module or transducer can be used to update one or more systems.

When the new software is required, you must install it if you wish to use the new software features (e.g., new transducer). If you choose not to install it, you must remove the transducer and replace it with one that is compatible with the software that is currently installed in your system.

When the software is optional, you can either install it or choose to use your existing software. If you choose not to install the software, the system will prompt you again whenever the system is started, and whenever the transducer is disconnected and then reconnected to the system.

Please refer to [Chapter 3, “Upgrading the System Software”](#) on page 41 for more information on software upgrades.

# Software Licensing

Use of the software that you receive from SonoSite is controlled by a license key. A license key is a number sequence containing exactly 12 decimal digits.

License keys are obtained from SonoSite or from its authorized representatives. You must obtain one key for each system that will use the new software. Refer to [Chapter 3, “Obtaining a License Key” on page 43](#) for information on obtaining a license key.

Software that you receive from SonoSite may be installed and will operate for a short period of time without requiring a valid license key. We refer to this period of time as the “grace period.” The grace period is variable.

When you first install your software, your SonoSite system will prompt you for a license key. If you have not yet obtained a valid license key, you can elect to use the software as long as the grace period time has not been fully consumed. We refer to this mode of operation as “running in the grace period.”

When a system is running in the grace period, all system functions are available. As you use the system, the grace period is slowly consumed. When the grace period has expired, the system will not be usable until a valid license key has been entered. Grace period time is not consumed while the system is powered off or when it is in “sleep” mode. Whenever a system is running in the grace period, the grace period time remaining is available on the license update screen. For information on displaying this screen, refer to [Chapter 3, “Installing a License Key” on page 44](#).

## **CAUTION:**

- ▶ When the grace period expires, all system functions except for licensing will become unavailable until a valid license key is entered into the system.





# .....Chapter 2: Safety

Please read this information before using the ultrasound system. It applies to the ultrasound system, transducers, accessories, and peripherals.

A **WARNING** describes precautions necessary to prevent injury or loss of life.

A **CAUTION** describes precautions necessary to protect the products.

## Electrical Safety

This system meets EN60601-1, Class I/internally-powered equipment requirements and Type BF isolated patient-applied parts safety requirements. The ECG cable meets safety requirements of EN 60601-2-25 for Type CF patient-applied part.

This system complies with the applicable medical equipment requirements published in the Canadian Standards Association (CSA), European Norm Harmonized Standard, and Underwriters Laboratories (UL) safety standards. See [Chapter 7, “Specifications”](#).

For maximum safety observe the following warnings and cautions:

### **WARNINGS:**

- ▶ To avoid discomfort or minor risk of patient injury, keep hot surfaces away from the patient.
- ▶ Under certain circumstances, the transducer connector and back of the display enclosure can reach temperatures that exceed EN60601-1 limits for patient contact, therefore only the operator shall handle the system. This does not include the transducer face.
- ▶ To avoid discomfort or minor risk of operator injury when handling the transducer connector, the system should not be operated for more than 60 minutes continuously in a live-scan mode (as opposed to freeze or sleep modes).
- ▶ To avoid the risk of electrical shock or injury, do not open the system enclosures. All internal adjustments and replacements, except battery replacement, must be made by a qualified technician.
- ▶ To avoid the risk of injury, do not operate the system in the presence of flammable gasses or anesthetics. Explosion can result.

- ▶ To avoid the risk of electrical shock, use only properly grounded equipment. Shock hazards exist if the AC power adapter is not properly grounded. Grounding reliability can only be achieved when equipment is connected to a receptacle marked “Hospital Only” or “Hospital Grade” or the equivalent. The grounding wire must not be removed or defeated.
- ▶ To avoid the risk of electrical shock, before using the transducer, inspect the transducer face, housing, and cable. Do not use the transducer, if the transducer or cable is damaged.
- ▶ To avoid the risk of electrical shock, always disconnect the AC power adapter from the system before cleaning the system.
- ▶ To avoid the risk of electrical shock, do not use any transducer that has been immersed beyond the specified cleaning or disinfection level. See [Chapter 6, “Troubleshooting and Maintenance”](#).
- ▶ To avoid the risk of electrical shock and fire hazard, inspect the AC power adapter cord and plug on a regular basis. Ensure they are not damaged.
- ▶ To avoid the risk of electrical shock, use only accessories and peripherals recommended by SonoSite. Connection of accessories and peripherals not recommended by SonoSite could result in electrical shock. Contact SonoSite or your local representative for a list of accessories and peripherals available from or recommend by SonoSite.
- ▶ To avoid the risk of electrical shock, use commercial grade peripherals recommended by SonoSite on battery power only. Do not connect these products to AC mains power when using the system to scan or diagnose a patient/subject. Contact SonoSite or your local representative for a list of the commercial grade peripherals available from or recommended by SonoSite.
- ▶ To prevent injury, only use market cleared ECG electrodes and cables.
- ▶ To avoid the risk of electrical shock to the patient/subject, ensure proper assembly of the ECG electrodes and cables.
- ▶ To avoid the risk of electrical shock to the patient/subject, do not touch the system battery contacts while simultaneously touching a patient/subject.
- ▶ To prevent injury to the operator/bystander, the transducer must be removed from patient contact before the application of a high-voltage defibrillation pulse.

**CAUTIONS:**

- ▶ Although your system has been manufactured in compliance with existing EMC/EMI requirements (EN60601-1-2), use of the system in the presence of an electromagnetic field can cause degradation of the ultrasound image. If this occurs often, SonoSite suggests a review of the system environment. Identify and remove the possible sources of the emissions or move your system.
- ▶ Electrostatic discharge (ESD), or static shock, is a naturally occurring phenomenon. ESD is common in conditions of low humidity, which can be caused by heating or air conditioning. Static shock is a discharge of the electrical energy from a charged body to a lesser or non-charged body. The degree of discharge can be significant enough to cause damage to a transducer or an ultrasound system. The following precautions can help reduce ESD: anti-static spray on carpets, anti-static spray on linoleum, and anti-static mats.
- ▶ Do not use the system if an error message appears on the image display: note the error code; call SonoSite or your local representative; turn off the system by pressing and holding the power switch until the system powers down.
- ▶ To avoid increasing the system and transducer connector temperature, do not block the airflow to the ventilation holes on the back of the system.

## Equipment Protection

To protect your ultrasound system, transducer, and accessories, follow these precautions.

**CAUTIONS:**

- ▶ The ECG cable emits electromagnetic interference when connected to the SonoSite system. It is not approved for use in-flight on aircraft.
- ▶ Excessive bending or twisting of cables can cause a failure or intermittent operation.
- ▶ Improper cleaning or disinfecting of any part of the system can cause permanent damage. For cleaning and disinfecting instructions, see [Chapter 6, “Troubleshooting and Maintenance”](#).
- ▶ Do not submerge the transducer connector in solution. The cable is not liquid-tight beyond the transducer connector/cable interface.
- ▶ Do not use solvents such as thinner or benzene, or abrasive cleaners on any part of the system.

- ▶ Remove the battery from the system if the system is not likely to be used for some time.
- ▶ Do not spill liquid on the system.

## Battery Safety

To avoid the battery bursting, igniting, or fumes from the battery and causing equipment damage, observe the following precautions:

### **WARNINGS:**

- ▶ The battery has a safety device. Do not disassemble or alter the battery.
- ▶ Charge the batteries only when the ambient temperature is between 0° and 40°C (32° and 104°F).
- ▶ Do not short-circuit the battery by directly connecting the positive and negative terminals with metal objects.
- ▶ Do not heat the battery or discard it in a fire.
- ▶ Do not expose the battery to temperatures over 60°C (140°F). Keep it away from fire and other heat sources.
- ▶ Do not charge the battery near a heat source, such as a fire or heater.
- ▶ Do not leave the battery in direct sunlight.
- ▶ Recharge the battery only with the SiteCharge dual battery charger or the system.
- ▶ Do not pierce the battery with a sharp object, hit it, or step on it.
- ▶ Do not use a damaged battery.
- ▶ Do not solder a battery.
- ▶ When connecting the battery to the SiteCharge dual battery charger or to the system, never reverse the polarity of the battery terminals.
- ▶ The polarity of the battery terminals are fixed and cannot be switched or reversed. Do not force the battery into the system or the SiteCharge dual battery charger.
- ▶ Do not connect the battery to an electrical power outlet.
- ▶ Do not continue recharging the battery if it does not recharge after two successive six hour charging cycles.

**CAUTIONS:**

- ▶ To avoid the battery bursting, igniting, or fumes from the battery and causing equipment damage, observe the following precautions:
- ▶ Do not immerse the battery in water or allow it to get wet.
- ▶ Do not put the battery into a microwave oven or pressurized container.
- ▶ If the battery leaks or emits an odor, remove it from all possible flammable sources.
- ▶ If the battery emits an odor or heat, is deformed or discolored, or in any way appears abnormal during use, recharging or storage, immediately remove it and stop using it. If you have any questions about the battery, consult SonoSite or your local representative.
- ▶ Store the battery between -20°C (-4°F) and 60°C (140°F).
- ▶ Use only SonoSite batteries.

## Biological Safety

Observe the following precautions related to biological safety.

**WARNINGS:**

- ▶ To prevent misdiagnosis, do not use the ECG trace to diagnosis cardiac rhythms. The SonoSite ECG option is a non-diagnostic feature.
- ▶ To prevent injury, only use market cleared ECG electrodes and cables.
- ▶ Non-medical (commercial) grade peripheral monitors have not been verified or validated by SonoSite as being suitable for diagnosis.
- ▶ Do not use the system if it exhibits erratic or inconsistent behavior. Discontinuities in the scanning sequence are indicative of a hardware failure that must be corrected before use.
- ▶ Do not use the system if it exhibits artifacts on the LCD screen, either within the clinical image or in the area outside of the clinical image. Artifacts are indicative of hardware and/or software errors that must be corrected before use.
- ▶ Some transducer covers contain natural rubber latex and talc, which can cause allergic reactions in some individuals. Refer to the FDA Medical Alert, March 29, 1991.
- ▶ Perform ultrasound procedures prudently. Use the ALARA (as low as reasonably achievable) principle.
- ▶ SonoSite does not currently recommend a specific brand of acoustic standoff.

## The ALARA Principle

ALARA is the guiding principle for the use of diagnostic ultrasound. Qualified sonographers, using good judgement and insight, determine the exposure that is as low as reasonably achievable. There are no rules sufficient to determine the correct response to every situation. So the sonographer keeps exposure low, bioeffects minimal, and images diagnostic.

A thorough knowledge of the imaging modes, transducer capability, system setup, and scanning technique is necessary. The imaging mode determines the nature of the ultrasound beam. A stationary beam results in greater exposure than a scanned beam, which moves over an area, spreading exposure over that area. Transducer capability depends upon transducer frequency, penetration, resolution, and field of view. System setup establishes the starting point and determines control adjustments from that point. Scanning technique depends upon sonographer knowledge and experience. Anatomy, physiology, pathology, physics, and system operation are also factors to consider in applying the ALARA principle.

There are variables which affect the way the sonographer implements the ALARA principle. These variables include body size, location of the bone relative to the focal point, attenuation in the body, and ultrasound exposure time. Exposure time is an especially useful variable, because it can be controlled by the sonographer. The ability to limit the exposure over time supports the ALARA principle.

### Applying ALARA

The system imaging mode selected by the sonographer is determined by the information required. 2D imaging provides anatomical information; CPD imaging provides information about the energy or amplitude strength of the Doppler signal over time at a given anatomical location; DCPD imaging provides information about the presence of detectable blood flow and the direction of blood flow using the energy or amplitude strength of the Doppler signal over time at a given anatomical location. Pulsed wave Doppler and continuous wave Doppler provide quantitative information regarding blood flow through vessels within the body. Tissue Harmonic Imaging (THI) uses higher received frequencies to reduce clutter, artifact, and improve resolution. M-mode provides documentation and measurements of anatomical motion over time. Understanding the nature of the imaging mode being used allows the trained sonographer to apply the ALARA principle.

Prudent use of ultrasound occurs when patient exposure to ultrasound is limited to the lowest ultrasound output for the shortest time necessary to achieve acceptable diagnostic results. Decisions that support prudent use are based on the type of

patient, exam type, patient history, ease or difficulty of obtaining diagnostically useful information, and potential localized heating of the patient due to transducer surface temperature.

The system limits transducer surface temperature to 41°C (106°F). A power monitor protection circuit protects against over-current conditions. If the power monitor protection circuit senses an over-current condition, then the drive current to the transducer is shut off immediately, preventing over-heating of the transducer surface. Validation of the power monitor protection circuit is performed under normal system operation.

The sonographer uses the system controls to adjust image quality and limit ultrasound output. The system controls are divided into three categories relative to output: controls that directly affect output, controls that indirectly affect output, and receiver controls.

## **Direct Controls**

The selection of exam type limits acoustic output through default. The acoustic output parameters that are set at default levels based on exam type are the mechanical index (MI) and the spatial peak temporal average intensity (ISPTA). The system does not exceed an MI of 1.0 for all exam types. It does not exceed 720 mW/cm<sup>2</sup> for all exam types. The system does not exceed a thermal index (TI) of 1.0 for all modes except for PW Doppler and CPD on the C15 transducer.

## **Indirect Controls**

The controls that indirectly affect output are controls affecting imaging mode, optimization, transducer selection, freeze, and depth. The imaging mode determines the nature of the ultrasound beam. Tissue attenuation is directly related to transducer frequency. The higher the PRF (pulse repetition frequency), the more output pulses occur over a period of time. The pen optimization selection increases the output for 2D mode. The PRF, sample volume controls, and cursor position change the output for PW Doppler. The cursor position changes the output for CW Doppler.

## **Receiver Controls**

The receiver controls are the gain controls. Receiver controls do not affect output. They should be used, if possible, to improve image quality before using controls that directly or indirectly affect output.



## Output Display

The system meets the AIUM output display standard for MI (see last reference listed in Related Guidance Documents below). The system and transducer combinations do not exceed an MI of 1.0 in any operating modes. Therefore, the MI output display is not required and is not displayed on the system for these modes.

The system meets the output display standard for system for TI. A continuous real-time display of TI is displayed on the screen for any transducer and imaging mode combination where the TI can exceed 1.0. Currently the PW Doppler imaging mode and CPD with the C15 transducer are the only modes where the TI exceeds 1.0. The index is continuously displayed in increments of 0.1.

The thermal index consists of three user selectable indices, and only one of these is displayed at any one time. In order to properly use the output display and meet the ALARA principle, the user selects an appropriate TI based on the specific exam being performed. SonoSite provides the AIUM Medical Ultrasound Safety reference which contains guidance on how to determine which TI is appropriate (see second reference listed in Related Guidance Documents below).

### Related Guidance Documents

- Information for Manufacturers Seeking Marketing Clearance of Diagnostic Ultrasound Systems and Transducers, FDA, 1997.
- Medical Ultrasound Safety, American Institute of Ultrasound in Medicine (AIUM), 1994. (A copy is included with each system.)
- Acoustic Output Measurement Standard for Diagnostic Ultrasound Equipment, NEMA UD2-1998.
- Acoustic Output Measurement and Labeling Standard for Diagnostic Ultrasound Equipment, American Institute of Ultrasound in Medicine, 1993.
- Standard for Real-Time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment, American Institute of Ultrasound in Medicine, 1998.

## Acoustic Output Measurement

Since the initial use of diagnostic ultrasound, the possible human biological effects (bioeffects) from ultrasound exposure have been studied by various scientific and medical institutions. In October 1987, the American Institute of Ultrasound in Medicine (AIUM) ratified a report prepared by its Bioeffects Committee (Bioeffects Considerations for the Safety of Diagnostic Ultrasound, J Ultrasound

Med., Sept. 1988: Vol. 7, No. 9 Supplement), sometimes referred to as the Stowe Report, which reviewed available data on possible effects of ultrasound exposure. Another report “Bioeffects and Safety of Diagnostic Ultrasound,” dated January 28, 1993 provides more current information.

The acoustic output for this ultrasound system has been measured and calculated in accordance with the “Acoustic Output Measurement Standard for Diagnostic Ultrasound Equipment” (NEMA UD 2-1998, and the “Standard for Real-Time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment” (AIUM and NEMA 1998).

### ***In Situ*, Derated, and Water Value Intensities**

All intensity parameters are measured in water. Since water does not absorb acoustic energy, these water measurements represent a worst case value. Biological tissue does absorb acoustic energy. The true value of the intensity at any point depends on the amount and type of tissue and the frequency of the ultrasound passing through the tissue. The intensity value in the tissue, *In Situ*, has been estimated by using the following formula:

$$In\ Situ = Water [e^{-(0.23al^2f)}]$$

where:

*In Situ* = *In Situ* intensity value

Water = Water intensity value

e = 2.7183

a = attenuation factor

tissue = a(dB/cm-MHz)

brain = 0.53

heart = 0.66

kidney = 0.79

liver = 0.43

muscle = 0.55

l = skinline to measurement depth in cm.

f = center frequency of the transducer/system/mode combination in MHz.

Since the ultrasonic path during the exam is likely to pass through varying lengths and types of tissue, it is difficult to estimate the true *In Situ* intensity. An attenuation factor of 0.3 is used for general reporting purposes; therefore, the *In Situ* value commonly reported uses the formula:

$$In\ Situ\ (derated) = Water [e^{-(0.069lf)}]$$

Since this value is not the true *In Situ* intensity, the term “derated” is used to qualify it.

The maximum derated and the maximum water values do not always occur at the same operating conditions; therefore, the reported maximum water and derated values may not be related by the *In Situ* (derated) formula. For example: a multi-zone array transducer that has maximum water value intensities in its deepest zone, but also has the smallest derating factor in that zone. The same transducer may have its largest derated intensity in one of its shallowest focal zones.

## Tissue Models and Equipment Survey

Tissue models are necessary to estimate attenuation and acoustic exposure levels *In Situ* from measurements of acoustic output made in water. Presently, available models may be limited in their accuracy because of varying tissue paths during diagnostic ultrasound exposures and uncertainties in the acoustic properties of soft tissues. No single tissue model is adequate for predicting exposures in all situations from measurements made in water, and continued improvement and verification of these models is necessary for making exposure assessments for specific exam types.

A homogeneous tissue model with attenuation coefficient of 0.3 dB/cm-MHz throughout the beam path is commonly used when estimating exposure levels. The model is conservative in that it overestimates the *In Situ* acoustic exposure when the path between the transducer and site of interest is composed entirely of soft tissue. When the path contains significant amounts of fluid, as in many first and second-trimester pregnancies scanned transabdominally, this model may underestimate the *In Situ* acoustic exposure. The amount of underestimation depends upon each specific situation.

Fixed-path tissue models, in which soft tissue thickness is held constant, sometimes are used to estimate *In Situ* acoustic exposures when the beam path is longer than 3 cm and consists largely of fluid. When this model is used to estimate maximum exposure to the fetus during transabdominal scans, a value of 1 dB/cm-MHz may be used during all trimesters.

Existing tissue models that are based on linear propagation may underestimate acoustic exposures when significant saturation due to non-linear distortion of beams in water is present during the output measurement.

The maximum acoustic output levels of diagnostic ultrasound devices extend over a broad range of values:

- A survey of 1990-equipment models yielded MI values between 0.1 and 1.0 at their highest output settings. Maximum MI values of approximately 2.0 are known to occur for currently available equipment. Maximum MI values are similar for real-time 2D and M-mode imaging.

- Computed estimates of upper limits to temperature elevations during transabdominal scans were obtained in a survey of 1988 and 1990 pulsed Doppler equipment. The vast majority of models yielded upper limits less than 1° and 4°C (1.8° and 7.2°F) for exposures of first-trimester fetal tissue and second-trimester fetal bone, respectively. The largest values obtained were approximately 1.5°C (2.7°F) for first-trimester fetal tissue and 7°C (12.6°F) for second-trimester fetal bone. Estimated maximum temperature elevations given here are for a “fixed path” tissue model and are for devices having  $I_{SPTA}$  values greater than 500 mW/cm<sup>2</sup>. The temperature elevations for fetal bone and tissue were computed based on calculation procedures given in Sections 4.3.2.1-4.3.2.6 in “Bioeffects and Safety of Diagnostic Ultrasound” (AIUM, 1993).

## Intended Uses

The intended uses for each exam type are contained here. See the intended transducer for exam type in [Table 1, “Transducer, Exam Type, and Imaging Mode,” on page 61](#).

### Abdominal Imaging Applications:

This system transmits ultrasound energy into the abdomen of patients using 2D, M-mode, color power Doppler (CPD), directional color power Doppler (DCPD), Tissue Harmonic Imaging (THI), pulsed wave (PW) Doppler, and continuous wave (CW) Doppler to obtain ultrasound images. The liver, kidneys, pancreas, spleen, gallbladder, bile ducts, transplanted organs, abdominal vessels, and surrounding anatomical structures can be assessed for the presence or absence of pathology.

### Cardiac Imaging Applications:

This system transmits ultrasound energy into the thorax of patients using 2D, M-mode, directional color power Doppler (DCPD), Tissue Harmonic Imaging (THI), pulsed wave (PW) Doppler, and continuous wave (CW) Doppler to obtain ultrasound images. The heart, cardiac valves, great vessels, surrounding anatomical structures, overall cardiac performance, and heart size can be assessed for the presence or absence of pathology. The patient’s electrocardiogram (ECG) may be obtained and is used for accurate timing of diastolic and systolic function.

### **WARNING:**

- The ECG is not used to diagnose cardiac arrhythmias and is not designed for long term cardiac rhythm monitoring.

### **Gynecology and Infertility Imaging Applications:**

This system transmits ultrasound energy in the pelvis and lower abdomen using 2D, M-mode, color power Doppler (CPD), directional color power Doppler (DCPD), Tissue Harmonic Imaging (THI), and pulsed wave (PW) Doppler to obtain ultrasound images. The uterus, ovaries, adnexa, and surrounding anatomical structures can be assessed for the presence or absence of pathology. This system can be used to monitor ovarian follicle size for fertility procedures and as an aid in chorionic villi sampling (CVS) procedures.

### **Interventional and Intraoperative Imaging Applications:**

This system transmit ultrasound energy into the various parts of the body using 2D, color power Doppler (CPD), directional color power Doppler (DCPD), Tissue Harmonic Imaging (THI), and pulsed wave (PW) Doppler to obtain ultrasound images that provide guidance during interventional and intraoperative procedures. This system can be used to provide ultrasound guidance for biopsy and drainage procedures, vascular line placement, ova harvesting, amniocentesis and other obstetrical procedures, and provide assistance during abdominal and vascular intraoperative procedures.

### **Obstetrical Imaging Applications:**

This system transmits ultrasound energy into the pelvis of pregnant women using 2D, M-mode, color power Doppler (CPD), directional color power Doppler (DCPD), Tissue Harmonic Imaging (THI), and pulsed wave (PW) Doppler to obtain ultrasound images. The fetal anatomy, viability, estimated fetal weight, gestational age, amniotic fluid, and surrounding anatomical structures can be assessed for the presence or absence of pathology. CPD and DCPD imaging is intended for high-risk pregnant women. High-risk pregnancy indications include, but are not limited to, multiple pregnancy, fetal hydrops, placental abnormalities, as well as maternal hypertension, diabetes, and lupus.

### **WARNING:**

- ▶ CPD or DCPD images can be used as an adjunctive method, not as a screening tool, for the detection of structural anomalies of the fetal heart and as an adjunctive method, not as a screening tool for the diagnosis of Intrauterine Growth Retardation (IUGR).

**Pediatric and Neonatal Imaging Applications:**

This system transmits ultrasound energy into the pediatric or neonatal patients using 2D, M-mode, color power Doppler (CPD), directional color power Doppler (DCPD), pulsed wave (PW) and continuous wave (CW) Doppler to obtain ultrasound images. The pediatric abdominal, pelvic and cardiac anatomy, pediatric hips, neonatal heads, and surrounding anatomical structures can be assessed for the presence or absence of pathology.

**Prostate Imaging Applications:**

This system transmits ultrasound energy into the prostate of an adult male using 2D, M-mode, color power Doppler (CPD), and pulsed wave (PW) Doppler to obtain ultrasound images. The prostate gland can be assessed for the presence or absence of pathology.

**Superficial Imaging Applications:**

This system transmits ultrasound energy into various parts of the body using 2D, M-mode, color power Doppler (CPD), and pulsed wave (PW) Doppler to obtain ultrasound images. The breast, thyroid, testicle, lymph nodes, hernias, musculoskeletal structures, soft tissue structures, and surrounding anatomical structures can be assessed for the presence or absence of pathology.

**Vascular Imaging Applications:**

This system transmits ultrasound energy into the various parts of the body using 2D, M-mode, color power Doppler (CPD), Tissue Harmonic Imaging (THI), and pulsed wave (PW) Doppler to obtain ultrasound images. The carotid arteries, deep veins in the arms and legs, superficial veins in the arms and legs, great vessels in the abdomen, and various small vessels feeding organs can be assessed for the presence or absence of pathology.

## About the Acoustic Output Table

The terms used in the acoustic output tables follow:

Transducer Model is the SonoSite transducer model.

**I<sub>SPTA.3</sub>** is the derated spatial peak, temporal average intensity in milliWatts/cm<sup>2</sup>.

**TI type** is the applicable thermal index for the transducer, imaging mode, and exam type.

**TI value** is the thermal index value for the transducer, imaging mode, and exam type.

**MI** is the mechanical index.

**I<sub>pa.3</sub>@MI<sub>max</sub>** in W/cm<sup>2</sup> is the derated pulse average intensity at the maximum MI.

**TIS** (soft tissue thermal index) is a thermal index related to soft tissues. TIS scan is the soft tissue thermal index in an auto-scanning mode. TIS non-scan is the soft tissue thermal index in the non-autoscanning mode.

**TIB** (bone thermal index) is a thermal index for applications in which the ultrasound beam passes through soft tissue and a focal region is in the immediate vicinity of bone. TIB non-scan is the bone thermal index in the non-autoscanning mode.

**TIC** (cranial bone thermal index) is the thermal index for applications in which the ultrasound beam passes through bone near the beam entrance into the body.

**A<sub>aprt</sub>** is the area of the active aperture measured in cm<sup>2</sup>.

**P<sub>r.3</sub>** the derated peak rarefactional pressure associated with the transmit pattern giving rise to the value reported under MI (Megapascals).

**W<sub>o</sub>** the ultrasonic power, except for TIS<sub>scan</sub>, in which case it is the ultrasonic power passing through a one centimeter window in milliwatts.

**W<sub>.3</sub>(z<sub>1</sub>)** is the derated ultrasonic power at axial distance z<sub>1</sub> in milliwatts.

**I<sub>SPTA.3</sub>(z<sub>1</sub>)** the derated spatial-peak temporal-average intensity at axial distance z<sub>1</sub> (milliwatts per square centimeter).

**z<sub>1</sub>** the axial distance corresponding to the location of maximum [min(W<sub>.3</sub>(z), I<sub>TA.3</sub>(z) x 1 cm<sup>2</sup>)], where z ≥ z<sub>bp</sub> in centimeters.

**z<sub>bp</sub>**  $1.69 \sqrt{(A_{aprt})}$  in centimeters.

**z<sub>sp</sub>** For MI, it is the axial distance at which p<sub>r.3</sub> is measured. For TIB, it is the axial distance at which TIB is a global maximum (i.e., z<sub>sp</sub> = z<sub>b.3</sub>) in centimeters.

**d<sub>eq</sub>(z)** is the equivalent beam diameter as a function of axial distance z, and is equal to  $\sqrt{(4/(\pi))((W_o)/(I_{TA}(z)))}$ , where I<sub>TA</sub>(z) is the temporal-average intensity as a function of z in centimeters.

**fc** is the center frequency in MHz.

**Dim.** of  $A_{\text{aprt}}$  are the active aperture dimensions for the azimuthal (x) and elevational (y) planes in centimeters.

**PD** is the pulse duration (microseconds) associated with the transmit pattern giving rise to the reported value of MI.

**PRF** is the pulse repetition frequency associated with the transmit pattern giving rise to the reported value of MI in Hertz.

**pr@PII<sub>max</sub>** is the peak rarefactional pressure at the point where the free-field, spatial-peak pulse intensity integral is a maximum in Megapascals.

**d<sub>eq</sub>@PII<sub>max</sub>** the equivalent beam diameter at the point where the free-field, spatial-peak pulse intensity integral is a maximum in centimeters.

**FL** the focal length, or azimuthal (x) and elevational (y) lengths, if different measured in centimeters.

### Acoustic Output Tables

Table 1 indicates the acoustic output for all system and transducer combinations with a thermal index and mechanical index less than one.

**Table 1: Acoustic Output**

Transducer Model	I <sub>SPTA.3</sub>	TI Type	TI Value	MI	I <sub>pa.3</sub> @MI <sub>max</sub>
C60/5-2 MHz	22	TIC	0.4	0.4	18.26
C15/4-2 MHz	84	TIC	0.7	0.7	48.06
C11/7-4 MHz	166	TIB	0.7	0.5	29.63
ICT/7-4 MHz	19	TIC	0.3	0.4	31.14
L38/10-5 MHz	169	TIC	0.5	0.6	111.3
HST	176	TIB	0.2	0.3	12.42

Table 2 through Table 7 indicate the acoustic output for the system and transducer combinations with a thermal index equal to or greater than one. This includes all transducers used in PW Doppler mode as well as the C15 in CPD mode.



Table 2: Transducer Model: C60

Operating Mode: *PW Doppler*

Index Label			M.I.	TIS		TIB	TIC	
				Scan	Non-scan			Non-scan
					$A_{\text{aprt}} \leq 1$	$A_{\text{aprt}} > 1$		
Global Maximum Index Value			(a)	—	—	< 1	1.9	(b)
Associated Acoustic Parameter	$p_{r,3}$ (MPa)		#					
	$W_0$ (mW)			—	—		57.633	#
	min of $[W_{.3}(z_1), I_{TA,3}(z_1)]$ (mW)					#		
	$z_1$ (cm)					#		
	$z_{bp}$ (cm)					#		
	$z_{sp}$ (cm)		#				1.875	
	$d_{eq}(z_{sp})$ (cm)						0.775	
	$f_c$ (MHz)		#	—	—	#	2.99	#
	Dim of $A_{\text{aprt}}$	X (cm)		—	—	#	0.875	#
Y (cm)			—	—	#	1.3	#	
Other Information	PD ( $\mu\text{sec}$ )		#					
	PRF (Hz)		#					
	$p_r@PII_{\text{max}}$ (MPa)		#					
	$d_{eq}@PII_{\text{max}}$ (cm)						0.329	
	Focal Length	$FL_x$ (cm)		—	—	#		#
		$FL_y$ (cm)		—	—	#		#
	$I_{PA,3}@MI_{\text{max}}$	(W/cm <sup>2</sup> )	#					
Operating Control Conditions	Control 1: Exam Type						Any	
	Control 2: Sample Volume						5 mm	
	Control 3: PRF						6250	
	Control 4: Sample Vol. Position						< 35 mm	

- (a) This index is not required for this operating mode; value is <1.  
 (b) This transducer is not intended for transcranial or neonatal cephalic uses.  
 # No data are reported for this operating condition since the global maximum index value is not reported for the reason listed. (Reference Global Maximum Index Value line.)  
 — Data is not applicable for this transducer/mode.

Table 3: Transducer Model: C15

Operating Mode: *PW Doppler*

Index Label			M.I.	TIS			TIB	TIC
				Scan	Non-scan		Non-scan	
					A <sub>aprt</sub> ≤1	A <sub>aprt</sub> >1		
Global Maximum Index Value			(a)	—	—	< 1	2.5	(b)
Associated Acoustic Parameter	P <sub>r.3</sub> (MPa)		#					
	W <sub>0</sub> (mW)			—	—		83.075	#
	min of [W <sub>.3</sub> (z <sub>1</sub> ), I <sub>TA.3</sub> (z <sub>1</sub> )] (mW)					#		
	z <sub>1</sub> (cm)					#		
	z <sub>bp</sub> (cm)					#		
	z <sub>sp</sub> (cm)		#				3.648	
	d <sub>eq</sub> (z <sub>sp</sub> ) (cm)						0.45	
	f <sub>c</sub> (MHz)		#	—	—	#	2.17	#
	Dim of A <sub>aprt</sub>	X (cm)		—	—	#	1.2478	#
		Y (cm)		—	—	#	1.3	#
Other Information	PD (μsec)		#					
	PRF (Hz)		#					
	p <sub>r</sub> @PII <sub>max</sub> (MPa)		#					
	d <sub>eq</sub> @PII <sub>max</sub> (cm)						0.44	
	Focal Length	FL <sub>x</sub> (cm)		—	—	#		#
		FL <sub>y</sub> (cm)		—	—	#		#
	I <sub>PA.3</sub> @MI <sub>max</sub>	(W/cm <sup>2</sup> )	#					
Operating Control Conditions	Control 1: Exam Type						Any	
	Control 2: Sample Volume						5 mm	
	Control 3: PRF						10417	
	Control 4: Sample Vol. Position						< 35 mm	

- (a) This index is not required for this operating mode; value is <1.  
 (b) This transducer is not intended for transcranial or neonatal cephalic uses.  
 # No data are reported for this operating condition since the global maximum index value is not reported for the reason listed. (Reference Global Maximum Index Value line.)  
 — Data is not applicable for this transducer/mode.

Table 4: Transducer Model: C11

Operating Mode: *PW Doppler*

Index Label			M.I.	TIS		TIB	TIC
				Scan	Non-scan	Non-scan	
					$A_{\text{aprt}} \leq 1$	$A_{\text{aprt}} > 1$	
Global Maximum Index Value			(a)	—	< 1	—	1
Associated Acoustic Parameter	Pr.3 (MPa)		#	—	—	—	—
	$W_0$ (mW)		—	—	#	—	20.529
	min of $[W_{.3}(z_1), I_{TA.3}(z_1)]$ (mW)		—	—	—	—	—
	$z_1$ (cm)		—	—	—	—	—
	$z_{bp}$ (cm)		—	—	—	—	—
	$z_{sp}$ (cm)		#	—	—	—	0.8
	$d_{eq}(z_{sp})$ (cm)		—	—	—	—	0.453
	$f_c$ (MHz)		#	—	#	—	5.33
	Dim of $A_{\text{aprt}}$	X (cm)	—	—	#	—	0.378
		Y (cm)	—	—	#	—	0.6
Other Information	PD ( $\mu\text{sec}$ )		#	—	—	—	—
	PRF (Hz)		#	—	—	—	—
	$p_r@PII_{\text{max}}$ (MPa)		#	—	—	—	—
	$d_{eq}@PII_{\text{max}}$ (cm)		—	—	—	—	0.232
	Focal Length	$FL_x$ (cm)	—	—	#	—	3.0
		$FL_y$ (cm)	—	—	#	—	2.0
	$I_{PA.3}@MI_{\text{max}}$ ( $\text{W}/\text{cm}^2$ )		#	—	—	—	—
Operating Control Conditions	Control 1: Exam Type		—	—	—	—	Any
	Control 2: Sample Volume		—	—	—	—	3 mm
	Control 3: PRF		—	—	—	—	10417
	Control 4: Sample Vol. Position		—	—	—	—	< 15 mm

- (a) This index is not required for this operating mode; value is <1.
- (b) This transducer is not intended for transcranial or neonatal cephalic uses.
- # No data are reported for this operating condition since the global maximum index value is not reported for the reason listed. (Reference Global Maximum Index Value line.)
- Data is not applicable for this transducer/mode.

Table 5: Transducer Model: *ICT*Operating Mode: *PW Doppler*

Index Label			M.I.	TIS		TIB	TIC	
				Scan	Non-scan			Non-scan
					A <sub>aprt</sub> ≤1	A <sub>aprt</sub> >1		
Global Maximum Index Value			(a)	—	< 1	—	1.6	(b)
Associated Acoustic Parameter	P <sub>r,3</sub> (MPa)		#					
	W <sub>0</sub> (mW)			—	#		21.534	#
	min of [W <sub>.3</sub> (z <sub>1</sub> ),I <sub>TA.3</sub> (z <sub>1</sub> )] (mW)					—		
	z <sub>1</sub> (cm)					—		
	z <sub>bp</sub> (cm)					—		
	z <sub>sp</sub> (cm)		#				0.8	
	d <sub>eq</sub> (z <sub>sp</sub> ) (cm)						0.47	
	f <sub>c</sub> (MHz)		#	—	#	—	5.33	#
	Dim of A <sub>aprt</sub>	X (cm)		—	#	—	0.324	#
Y (cm)			—	#	—	0.6	#	
Other Information	PD (μsec)		#					
	PRF (Hz)		#					
	p <sub>r</sub> @P <sub>II</sub> <sub>max</sub> (MPa)		#					
	d <sub>eq</sub> @P <sub>II</sub> <sub>max</sub> (cm)						0.228	
	Focal Length	FL <sub>x</sub> (cm)		—	#	—		#
		FL <sub>y</sub> (cm)		—	#	—		#
	I <sub>PA.3</sub> @M <sub>I</sub> <sub>max</sub> (W/cm <sup>2</sup> )		#					
Operating Control Conditions	Control 1: Exam Type						Any	
	Control 2: Sample Volume						3 mm	
	Control 3: PRF						15625 or 20833	
	Control 4: Sample Vol. Position						< 13 mm	

(a) This index is not required for this operating mode; value is &lt;1.

(b) This transducer is not intended for transcranial or neonatal cephalic uses.

# No data are reported for this operating condition since the global maximum index value is not reported for the reason listed. (Reference Global Maximum Index Value line.)

— Data is not applicable for this transducer/mode.

Table 6: Transducer Model: L38

Operating Mode: *PW Doppler*

Index Label			M.I.	TIS		TIB	TIC	
				Scan	Non-scan			Non-scan
					A <sub>aprt</sub> ≤1	A <sub>aprt</sub> >1		
Global Maximum Index Value			(a)	—	<1	—	1.2	(b)
Associated Acoustic Parameter	Pr.3 (MPa)		#					
	W <sub>0</sub> (mW)			—	#		17.502	#
	min of [W <sub>.3</sub> (z <sub>1</sub> ), I <sub>TA.3</sub> (z <sub>1</sub> )] (mW)					—		
	z <sub>1</sub> (cm)					—		
	z <sub>bp</sub> (cm)					—		
	z <sub>sp</sub> (cm)		#				1.0	
	d <sub>eq</sub> (z <sub>sp</sub> ) (cm)						0.40	
	f <sub>c</sub> (MHz)		#	—	#	—	5.32	#
	Dim of A <sub>aprt</sub>	X (cm)		—	#	—	0.72	#
		Y (cm)		—	#	—	0.4	#
Other Information	PD (μsec)		#					
	PRF (Hz)		#					
	p <sub>r</sub> @PII <sub>max</sub> (MPa)		#					
	d <sub>eq</sub> @PII <sub>max</sub> (cm)						0.169	
	Focal Length	FL <sub>x</sub> (cm)		—	#	—		#
		FL <sub>y</sub> (cm)		—	#	—		#
	I <sub>PA.3</sub> @MI <sub>max</sub> (W/cm <sup>2</sup> )		#					
Operating Control Conditions	Control 1: Exam Type						Any	
	Control 2: Sample Volume						2 mm	
	Control 3: PRF						10417, 15625, or 20833	
	Control 4: Sample Vol. Position						27.5–37.5 mm	

(a) This index is not required for this operating mode; value is &lt;1.

(b) This transducer is not intended for transcranial or neonatal cephalic uses.

# No data are reported for this operating condition since the global maximum index value is not reported for the reason listed. (Reference Global Maximum Index Value line.)

— Data is not applicable for this transducer/mode.

Table 7: Transducer Model: C15

Operating Mode: *Color Power Doppler*

Index Label			M.I.	TIS		TIB	TIC	
				Scan	Non-scan			Non-scan
					A <sub>aprt</sub> ≤1	A <sub>aprt</sub> >1		
Global Maximum Index Value			(a)	—	<1	—	<1	1
Associated Acoustic Parameter	P <sub>r.3</sub> (MPa)		#					
	W <sub>0</sub> (mW)			—	#		#	83.094
	min of [W <sub>.3</sub> (z <sub>1</sub> ), I <sub>TA.3</sub> (z <sub>1</sub> )] (mW)					—		
	z <sub>1</sub> (cm)					—		
	z <sub>bp</sub> (cm)					—		
	z <sub>sp</sub> (cm)		#				#	
	d <sub>eq</sub> (z <sub>sp</sub> ) (cm)						#	
	f <sub>c</sub> (MHz)		#	—	#	—	#	2.268
	Dim of A <sub>aprt</sub>	X (cm)		—	#	—	#	1.468
Y (cm)			—	#	—	#	1.3	
Other Information	PD (μsec)		#					
	PRF (Hz)		#					
	p <sub>r</sub> @PII <sub>max</sub> (MPa)		#					
	d <sub>eq</sub> @PII <sub>max</sub> (cm)						#	
	Focal Length	FL <sub>x</sub> (cm)		—	#	—		6.2
		FL <sub>y</sub> (cm)		—	#	—		7
	I <sub>PA.3</sub> @MI <sub>max</sub>	(W/cm <sup>2</sup> )	#					
Operating Control Conditions	Control 1: Exam Type							Abd or OB
	Control 2: Optimization							medium
	Control 3: Harmonics							TH on
	Control 4: Depth							9.8

(a) This index is not required for this operating mode; value is &lt;1.

(b) This transducer is not intended for transcranial or neonatal cephalic uses.

# No data are reported for this operating condition since the global maximum index value is not reported for the reason listed. (Reference Global Maximum Index Value line.)

— Data is not applicable for this transducer/mode.

## Global Maximum Derated $I_{SPTA}$ and MI Values

The following values represent worst-case values of the  $I_{SPTA,3}$  and MI for each transducer and each mode, over all operating conditions for that mode. These tables fulfill the requirements of Appendix G, Section C2, of the September 30, 1997 issue of the FDA document, "Information for Manufacturers Seeking Marketing Clearance of Diagnostic Ultrasound Systems and Transducers."

**Table 8: C60/5-2 Transducer**

Transducer Model	Imaging Mode	Derated $I_{SPTA}$	MI
C60/5-2 MHz	2D	6	0.4
	DCPD	15	0.4
	M-mode	22	0.4
	PW Doppler	437	0.5

**Table 9: C15/4-2 Transducer**

Transducer Model	Imaging Mode	Derated $I_{SPTA}$	MI
C15/4-2 MHz	2D	13	0.7
	DCPD	44	0.7
	M-mode	68	0.7
	PW Doppler	405	0.7
	CW Doppler	84	< 0.1

**Table 10: C11/7-4 Transducer**

Transducer Model	Imaging Mode	Derated $I_{SPTA}$	MI
C11/7-4 MHz	2D	5	0.5
	CPD	43	0.4
	M-mode	28	0.5
	PW Doppler	479	0.4
	CW Doppler	166	<0.1

**Table 11: ICT/7-4 Transducer**

Transducer Model	Imaging Mode	Derated $I_{SPTA}$	MI
ICT/7-4 MHz	2D	3	0.4
	CPD	9	0.3
	M-mode	19	0.4
	PW Doppler	447	0.4

**Table 12: L38/10-5 Transducer**

Transducer Model	Imaging Mode	Derated $I_{SPTA}$	MI
L38/10-5 MHz	2D	23	0.6
	CPD	66	0.6
	M-mode	169	0.6
	PW Doppler	460	0.6

**Table 13: HST Transducer**

Transducer Model	Imaging Mode	Derated $I_{SPTA}$	MI
HST	2D	4	0.3
	CPD	13	0.3
	M-mode	13	0.3
	PW Doppler	176	0.3



## Acoustic Measurement Precision and Uncertainty












All table entries have been obtained at the same operating conditions that give rise to the maximum index value in the first column of the table. Measurement precision and uncertainty for power, pressure, intensity, and other quantities that are used to derive the values in the acoustic output table are shown in the table below. In accordance with Section 6.4 of the Output Display Standard, the following measurement precision and uncertainty values are determined by making repeat measurements and stating the standard deviation as a percentage.










**Table 14: Acoustic Measurement Precision and Uncertainty**


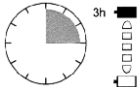
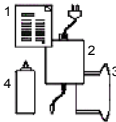




Quantity	Precision (% of standard deviation)	Uncertainty (95% confidence)
Pr	2.2%	±13%
Pr <sub>3</sub>	5.4%	±15%
Wo	6.2%	±19%
fc	< 1%	±4.5%
Pll	3.2%	+19% to -23%
Pll <sub>3</sub>	3.2%	+21% to -24%

## Labeling Symbols

The following symbols are found on the products, packaging, and containers.

Symbol	Definition
	Do not get wet
	Type BF patient applied part (B = body, F = floating applied part)
	Type CF patient applied part (C = cardiac, F = floating applied part)
	Indoor use only
	Storage temperature conditions
	Direct Current (DC)
	Alternating Current (AC)
	CE marking indicating Manufacturers declaration of compliance with appropriate EU product directives
	CE marking indicating compliance with the EU Medical Device Directive (93/42/EEC) and certified by the British Standards Institution
 LISTED UL1950 78BM	Underwriter's Laboratories labeling
	Canadian Standards Agency
REF	Catalog number

Symbol	Definition
H EÜ01	H marking indicating compliance with Annex II of EuM Decree 47/1999 (X.6.) by the Institute for Hospital and Medical Engineering of Hungary
SN	Serial number type of control number
	Batch code, date code, or lot code type of control number
	Collect separately from other household waste (see European Commission Directive 93/86/EEC). Refer to local regulations for disposal
	Attention, see the User Guide
	Fragile
	Date of manufacture
	Caution: hot surface
	Do not stack over 5 high
	Do not stack over 10 high
	Paper Recycle
IPX 7	Submersible. Protected against the effects of temporary immersion
IPX 1	Protected against vertically falling raindrops

Symbol	Definition
	Corrugated recycle
	Charge battery for 3 hours
	User Guide (1) Power supply (2) Battery (3) Ultrasound gel (4)
	Electrostatic sensitive devices
	D: pulsed wave/continuous wave Doppler CPD: color power Doppler/ directional color Power Doppler M: M-mode 2D: 2D grayscale
	ECG label depicting proper lead placement RA = white LL = red LA = black
	European Union ECG label depicting proper lead placement R = red F = green L = yellow



# .....Chapter 3: Preparing the System

## Connecting and Removing Transducers

There are five transducers available for the SonoSite system.

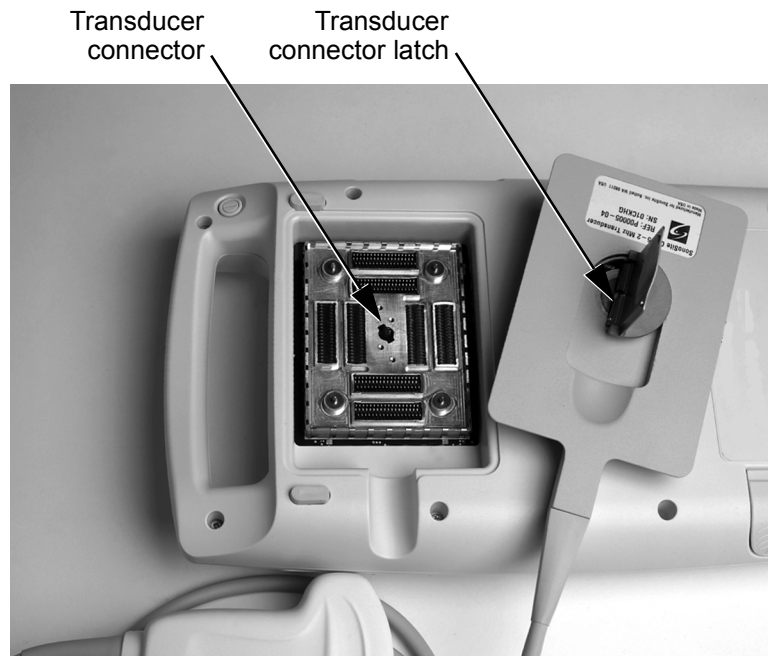
*Note: Only one transducer can be connected to the system at a time.*

### **WARNING:**

- ▶ The transducer connector can become hot during operation. This is normal. Operate the system in the SiteStand mobile docking station or on a flat, hard surface to allow air flow past the connector.

### **CAUTION:**

- ▶ The electrical contacts inside the system transducer connector may be damaged by foreign material or by rough handling. Do not touch the electrical contacts. Keep foreign material out of the connector. Keep a transducer connected to the system whenever possible.



**To connect the transducer:**

- 1 On the transducer connector, pull the latch up and rotate it clockwise until it snaps to a stop. The latch should be easy to move. Do not force the latch.
- 2 Align the transducer connector with the connector on the rear of the system and insert it by pushing the transducer connector into the system connector. The transducer connector should be easy to insert. Do not force the transducer connector.
- 3 Turn the latch counterclockwise until it snaps to a stop.
- 4 Press the latch down until it snaps into place, securing the transducer connector to the system.

**To remove the transducer:**

- 1 On the transducer connector, pull the latch up and rotate it clockwise until it snaps to a stop.
- 2 Carefully pull the transducer connector away from the system.

## Turning the System On or Off

When turning power on or off, you must push and hold the Power switch for approximately one second before the system responds. This feature prevents battery discharge, resulting from accidentally turning the system on. It also prevents accidentally turning the system off during an exam.

The first time you turn on the system, set the date and time. See [“To set the date and time:” on page 51](#).

**CAUTION:**

- ▶ Do not use the system if an error message appears on the image display. Note the error code. Call SonoSite or your local representative. When an error code occurs, turn off the system by pressing and holding the power switch until the system powers down.

**To turn power on/off:**

- 1 Locate the Power switch on the back of the left side of the system handle. See the System Controls photograph in [Chapter 1 on page 5](#).
- 2 Press and hold the Power switch until the system beeps (approximately one second).
- 3 Release the Power switch.

**To wake up the system:**

The system has a sleep delay, which is activated through the sleep delay system setup. When the battery charge indicators are blinking, but the other system lighting is off, press any key to wake up the system.

## Installing and Removing Battery

The battery comprises six lithium-ion cells (two sets of three connected in series) plus electronics, a temperature sensor, and the battery contacts. When in use, it is inserted into the system.

**WARNING:**

- ▶ If you are holding the system, when you remove the battery, place your hand beneath the battery. If it falls to the floor, it could be damaged, or cause personal injury.

If the battery is being installed for the first time, it will need to be charged. See [“Checking and Charging the Battery” on page 47](#). Make sure to remove the protective tape from the battery contacts before charging the battery.



### To install the battery:

- 1 Locate the battery compartment at the bottom of the system.
- 2 To install a new battery (label side up) into the battery compartment, push it into the compartment until both sides click into place. (Do not force the battery into the compartment, check the battery orientation if the battery is difficult to install.) Ensure that both sides of the battery are fully connected and that the battery release button is not pressed.



### To remove the battery:

- 1 Turn off the system.
- 2 Locate the battery compartment at the bottom of the system.

#### **WARNING:**

- ▶ If you are holding the system, when you remove the battery, place your hand beneath the battery. If it falls to the floor, it could be damaged, or cause personal injury.
- 3 To release the battery, press the battery release button (lower, right side) on the system.

## Using AC Power

The battery charges when the system is using AC power. If the system is off and connected to AC power, a fully discharged battery will charge in about three hours.

### To operate the system using AC power:

- 1 Connect the AC line cord of the AC power adapter to a hospital-grade electrical outlet.
- 2 Connect the DC line cord of the AC power adapter to the power connector on the system. See arrow labeled 1 in the figure below.
- 3 Connect the AC power adapter to the system using the upper, left connector on the left side of the system.

See [Table 1, “System Connectors,” on page 48](#) for placement of connectors.

## Upgrading the System Software

As described in [Chapter 1, “Read This First,” on page 1](#), transducers that you receive from SonoSite may contain either required or optional upgrades to the system software that resides on your SonoSite system.

Whenever you connect a transducer to a SonoSite system, the system communicates with the transducer to determine if it contains software that would upgrade the system.

### **CAUTION:**

- ▶ Initiating any upgrade of the system software erases any images stored on your system. Do not upgrade the system software until you have determined that any stored images are no longer needed.

### To upgrade the system software:

- 1 When you first connect a transducer with new software and turn the system on, the following message is displayed:

Do you want to upgrade the system software?

#### **For required upgrades:**

You must either perform the upgrade or replace the transducer with one that is compatible with the software currently installed on your system. Do one of the following:

- Select no (disconnect transducer) to reject the system software upgrade.
- Select yes (up to 20 minutes) to accept the system software upgrade and go to step 2.

**For optional upgrades:**

You may either install the new software or continue to use the existing software. SonoSite recommends that you install these optional upgrades soon after receiving them. Do one of the following:

- Select no (continue) to use the system without upgrading.
- Select yes (up to 20 minutes) to accept the upgrade and go to step 2.

- 2** When you have accepted the upgrade, the system loads the new software and displays the following message:

Upgrade in progress (20 minutes total).

*Note: The system upgrade can take up to 20 minutes; however, many software upgrades will be completed in less time.*

To cancel the upgrade in progress, select cancel.

**If this is a required upgrade:**

- The existing software remains installed.
- The system displays the following message:  
Incompatible transducer, upgrade the system software.

**If this is an optional upgrade:**

- The existing software remains installed.
- The system will go to live scan.

- 3** When the system has loaded the new software, the following message is displayed:

Successful upgrade.

If the software upgrade is unsuccessful, the system displays an error code and you must contact SonoSite technical support at 1-877-657-8118.

- 4** Select reboot to restart your system.

During the restart, the initial system screen shows two progress indicator bars. These progress indicator bars are present while the system is replacing its operating software and disappear when the process is completed.

When the operating software has been replaced, the system presents you with the license update screen so that you may license the software. At this point, the software upgrade process is complete, but the system software is not yet licensed. The following section explains how to license your software.

## Obtaining a License Key

A license key is required to update your SonoSite system. It may be obtained by doing one of the following:

If you encounter difficulty with the system, use the information in this chapter to help correct the problem. If the problem is not covered here, call SonoSite technical support at the following numbers or addresses:

USA/Canada Customers

- Technical support: **1-877-657-8118**
- Technical support fax and email: **1-425-951-6700**; **service@sonosite.com**
- SonoSite website: [www.sonosite.com](http://www.sonosite.com)

International Customers

- Call your local representative or **1-425-951-1330**.

To receive your license key, you will need to provide the following information, which is displayed on the system information screen of your system (except for the person installing the upgrade and the system serial number):

- Name of the person installing the upgrade
- System serial number (SN) (located on the back of your system)
- ARM Ver: (version)
- PCBA Serial No: (number)


See [“To display the system information screen:”](#) on page 45.

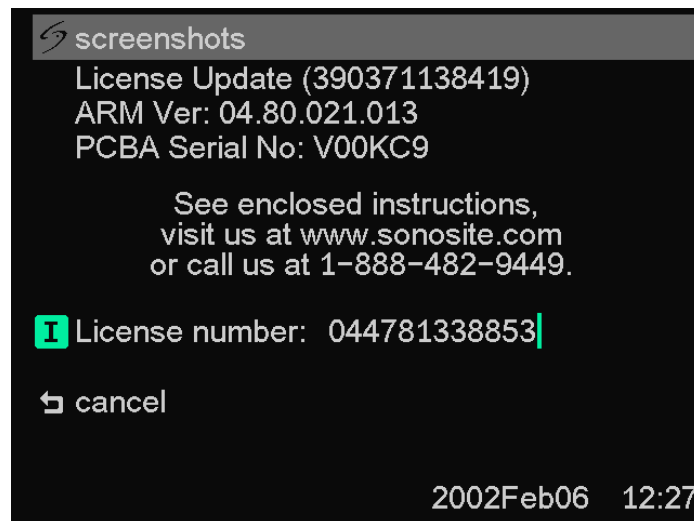
## Installing a License Key

When you have obtained a license key for your software, you must enter it into the system. Once a valid license key has been entered, the system remains licensed until the next time the system software is upgraded.

- 1 Turn on the system.


If the software is not yet licensed, the license update screen displays.

The license update screen displays the following information: the License Update number, the ARM Ver (version), the PCBA Serial No. (number), the SonoSite web site address and telephone number, the license number, the register later or done , and the grace period (time remaining) on your system.



*Note: The software versions on your system may vary based on your upgrade and configuration.*

- 2 Enter your license key in the license number field.

If the license key that you entered is recognized by the system as being valid for your system and the software you installed, done appears on-screen. Select done  from the on-screen menu to install the license key and license your software.

If the license key that you entered is not recognized by the system, the register later button remains on the screen as long as the defined grace period has not expired.

If the grace period has expired, the menu item will indicate this by showing zero hours remaining in the grace period. At this point, you must then enter a valid license key before you can use the system with this or any other transducer.

*Note: If you have entered a valid license key and you cannot complete the licensing procedure, verify that the license key has been entered correctly. The license key should be exactly 12 digits (for example, 123348990552) with no other characters or punctuation.*

*Note: If after confirming correct entry of the license key, you are still unable to license your system, call SonoSite technical support. USA/Canada customers call 1-877-657-8118. International customers call your local representative or 1-425-951-1330.*

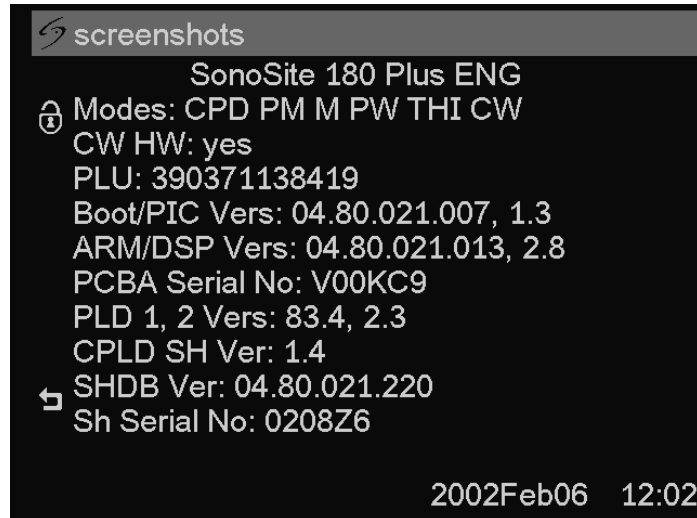
If the system is on and the grace period expires, the license update screen must be displayed from the system information screen.

**To display the system information screen:**

- 1** Press and release the Function key.
- 2** Press and release I. The system information screen displays.

The system information screen displays the following information: the Boot/PIC Vers (version), the ARM/DSP Vers, the PCBA Serial No (number), the Product Name, the Status, the PLD 1, 2, Vers, CPLD SH Ver, SHDB Ver (scanhead database version), and the Sh Serial No (scanhead serial number).

*Note: The software versions on your system may vary based on your upgrade and configuration.*




**To display the license update screen:**

- 1** On the system information screen, select the unlock icon (upper left corner of the screen).  
The license update screen displays.
- 2** Perform the steps in [“Installing a License Key” on page 44.](#)

## Checking and Charging the Battery

### To check the battery:

*Note: Disconnect the system from AC power prior to checking the battery charge.*

Five LEDs (light-emitting diodes) on the right side of the system monitor allow you to check the battery condition. If all LEDs are lit, the battery is fully charged. A solid gray battery icon  in the lower right portion of the system display indicates that a battery is properly installed. When there is approximately 10 minutes of battery life remaining, the gray battery icon will flash. At 2 minutes of battery life remaining, the battery icon turns white and the system beeps.

The system will operate on a fully-charged battery for 1.5 to 4 hours, depending upon use. Ensure the battery is charged at all times to provide the longest possible battery operation. You can set the sleep delay and power delay to prolong battery life. See [“Using System Setup” on page 51](#).

When the system is not likely to be used for some time, to prevent total battery discharge, remove the battery from the system.

### To charge the battery in the system:

#### **CAUTION:**


- ▶ Charge batteries only when the ambient temperature is between 0° and 40°C (32° and 104°F).
- 1** Connect the AC line cord of the AC power adapter to a hospital-grade electrical outlet.
- 2** Connect the DC line cord of the AC power adapter to the power connector on the system. See arrow labeled 1 in the figure below.
- 3** Charge the battery until it is fully charged.

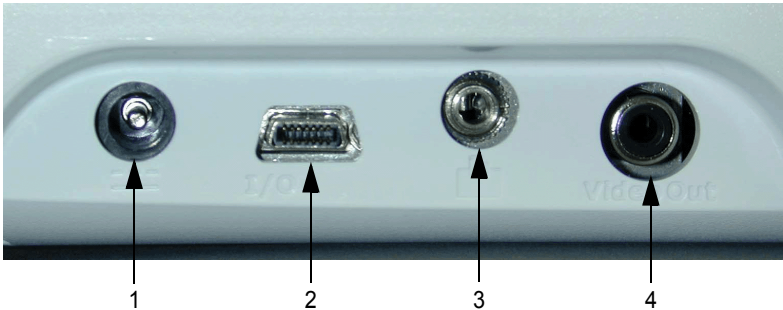
*Note: It takes about three hours to charge a battery when the system is off.*
- 4** Disconnect the system from AC power.
- 5** Turn the system on to check the battery charge.

*Note: If the system power is off, the five battery LEDs will light up and then flash to indicate that the battery is charging. The LEDs will turn off once the battery is fully charged.*



**To verify that power is connected:**

The system can be powered by the DC power input connector plugged directly into the system, or from the SiteStand. A power plug icon  in the lower right portion of the system display indicates that DC is properly connected and that the system is operating off this power. If both the power plug icon and the battery icon are present, the battery is properly installed and the system is operating off of DC power.



**Table 1: System Connectors**

Number	Feature
1	DC power input connector
2	I/O connector
3	Print/ VCR control connector for a recommended printer or VCR
4	Video out connector for a recommended VCR, printer, or external video monitor

## Using the SiteCharge® Dual Battery Charger



### To use the SiteCharge dual battery charger:

- 1** Connect the power adapter to the SiteCharge dual battery charger.
- 2** Connect the AC line cord to a power connector.

The blue SonoSite logo on the front of the SiteCharge dual battery charger lights.

- 3** Insert one or two batteries into the SiteCharge dual battery charger (the batteries only fit one way).

Refer to the following table for SiteCharge dual battery charger information on indicator light color, status, what it indicates, and the solution if necessary.

*Note: When the battery reaches full charge, both the yellow and green LEDs may be lit or may be flashing.*

**Table 2: Battery Status**

Light Color (next to battery)	Status	Indicates	Solution
Yellow	Lit	The battery is charging. It may take up to 60 seconds for the yellow light to come on depending on the discharge state of the battery.	
Yellow	Lit	When lit for more than six hours, charging will be suspended.	Remove and reinsert the same battery. If the battery is not fully charged within another six hours, call SonoSite or your local representative.
Yellow	Flashing	The battery is not properly installed. The battery or the SiteCharge dual battery charger is defective. The ambient temperature is below 0°C (32°F) or greater than 40°C (104°F).	Re-install the battery into the SiteCharge dual battery charger. If the battery is properly installed and the yellow light still flashes, call SonoSite or your local representative.
Green	Lit	The battery is fully charged and is ready for use. (The SiteCharge dual battery charger can charge one or two batteries in less than four and a half hours, depending on the discharge state of the battery.)	
Green	Lit	During an over-temperature condition, charging has been suspended.	Call SonoSite or your local representative.

## Using System Setup

System setup is used to customize your system. It is available by pressing the Patient key and selecting system setup. System setup includes settings for OCR (on/off), the thermal index selection (TIS/TIB/TIC), and the pictograph (on/off), and Doppler Scale (cm/s, kHz). System setup also includes screen information settings that allow you to show or hide the following items: the optimize icon, the time, the memory icon, and the patient name. You can also set the audible beep, sleep delay, power delay, and date/time. Additionally, system setup includes the video format, printer/VCR, calcs authors, and function key assignment. You can return to imaging from any system setup function by pressing the Patient key.

Perform the following procedures to become familiar with using the system setup, then use these basic operations to set the range of setups required for your uses.

### To set the date and time:

#### **WARNING:**

- ▶ An accurate date and time are critical for accurate obstetrics calculations. Verify that the date and time are accurate before each use of the system. The system does not automatically adjust for daylight savings time changes.

- 1** Press the Patient key.  
A menu appears on which system setup is listed.
- 2** Select system setup.  
A menu appears on which is listed audio, power, date/time.
- 3** Select audio, power, date/time.
- 4** Select date/time.  
A cursor appears at the left side of the date/time display.
- 5** Type in the current date (year, month, day) and time in 24-hour format (hours, minutes).  
If you make a mistake, you can use the Arrow keys (◀ ▶) between the Backspace (←) and Enter keys to move the cursor.
- 6** Press the Patient key to return to imaging.

**To set sleep delay:**

- 1 Repeat steps 1 through 3 in “To set the date and time:”
- 2 Select sleep delay (min).
- 3 Press sleep delay (min) again to select off, 5, or 10.
- 4 Press the Patient key to return to imaging.

**To set power delay:**

- 1 Repeat steps 1 through 3 in “To set the date and time:”
- 2 Select power delay (min).
- 3 Press power delay (min) again to select off, 15, or 30.
- 4 Press the Patient key to return to imaging.

**To turn on or off the audible beep:**

- 1 Repeat steps 1 through 3 in “To set the date and time:”
- 2 Select audible beep.
- 3 Press audible beep again to select on or off.
- 4 Press the Patient key to return to imaging.

**To set the Thermal Index (TI):**

- 1 Press the Patient key.  
A menu appears on which system setup is listed.
- 2 Select system setup.  
A menu appears on which is listed OCR, TI, picto, Doppler.
- 3 Select OCR, TI, picto, Doppler.
- 4 Select thermal index.
- 5 Select thermal index until the desired TIS, TIB, or TIC is selected.
- 6 Press the Patient key to return to imaging.

**To turn on or off the OCR feature for DICOM:**

- 1 Press the Patient key.  
A menu appears on which system setup is listed.
- 2 Select system setup.  
A menu appears on which is listed OCR, TI, picto, Doppler.
- 3 Select OCR, TI, picto, Doppler.
- 4 Select OCR.

- 5 Select OCR again to select on or off.

The banner area of the screen turns black when OCR is turned on.

- 6 Press the Patient key to return to imaging.

*Note: You must always turn on the OCR feature prior to saving an image. Images saved without the feature turned on may not be properly identified when read by the DICOM product.*

### **CAUTIONS:**

- ▶ To ensure that the patient name is read correctly by the OCR software, set up the name order choice, e.g., last name first, on the ALI NewPORT 2.1 product, refer to the *ALI NewPORT 2.1 Image Capture Station User's Guide*.
- ▶ To ensure that the patient name is read correctly by the OCR software, do not separate the patient's last name by a space when there are two last names, e.g., St.Pierre, VanDekamp, or Jones-Smith.
- ▶ To ensure that the patient's name is read correctly by the OCR software, do not place a hyphen at the end of the last name, e.g., Smith Jones-.

### **To set up a recommended printer:**

To use the system print controls, print, and print all images, the printer control cable must be connected to the system.

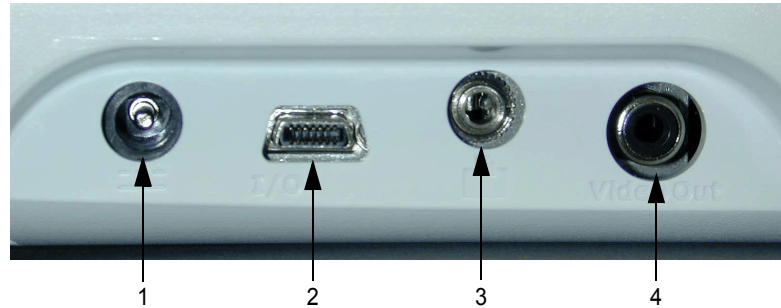
### **CAUTION:**

- ▶ Use only peripherals recommended by SonoSite with the system. Your system can be damaged by connecting a peripheral not recommended by SonoSite.

- 1 Connect a recommended printer to the system using the recommended print control cable and a video output cable.


The connectors are on the left side of the system. There are two connections that are required: Print control connector and video out connector. See arrows labeled 3 and 4 in [Table 3, "System Connectors," on page 54](#).

If you have questions about medical grade and non-medical grade system peripherals, refer to, [Chapter 1, "Read This First"](#).



**Table 3: System Connectors**

Number	Feature
1	DC power input connector
2	I/O connector
3	Print/ VCR control connector for a recommended printer or VCR
4	Video out connector for a recommended VCR, printer, or external video monitor

- 2** Turn on the printer.  
Refer to the manufacturer's instructions for specific printer information.
- 3** Press the Patient key.  
A menu appears on which is listed system setup.
- 4** Select system setup.  
A menu appears on which is listed video, printer/VCR, calcs, f keys.
- 5** Select video, printer/VCR, calcs, f keys.
- 6** Select printer/VCR key from the on-screen menu and set it for the type of printer connected to the system.  
*Note: Only the printers appearing as settings are recommended for use with the system.*  
The printer setup is ready to print.
- 7** Press the Patient key to return to imaging.
- 8** Press the Print/VCR key  or use the controls on the printer to print.

## To set up the recommended VCR:

*Note: This feature is dependent on the hardware configuration.*

### CAUTIONS:

- ▶ Use only peripherals recommended by SonoSite with the system. Your system can be damaged by connecting a peripheral not recommended by SonoSite.
- ▶ To prevent recording over images stored on a VCR videotape, make sure the proper peripheral is selected in system setup. With a VCR connected, the VCR will begin recording when the black and white (B&W) printer is selected in system setup. The only way to stop the VCR recording is to use the controls on the VCR.

- 1 Connect a recommended VCR to the system using the recommended VCR control cable and a video output cable.

The connectors are on the left side of the system. There are two connections that are required: VCR control connector and video out connector. See arrows labeled 3 and 4 in [Table 3, “System Connectors,”](#) on page 54.

If you have questions about medical grade and non-medical grade system peripherals, refer to, [Chapter 1, “Read This First”](#).

- 2 Turn on the VCR.

Refer to the manufacturer’s instructions for specific VCR information.

- 3 Press the Patient key.

A menu appears on which is listed system setup.

- 4 Select system setup.

A menu appears on which is listed video, printer/VCR, calcs, f keys.

- 5 Select video, printer/VCR, calcs, f keys.


- 6 Select the appropriate video format: NTSC or PAL.

- 7 Select printer/VCR key from the on-screen menu and set it for VCR.

*Note: Only the VCR appearing as a setting is recommended for use with the system.*

The VCR setup is ready to record.

- 8 Press the Patient key to return to imaging.

- 9 Press the Print/VCR key  or use the controls on the VCR to record the image display.

*Note: Audio recording is only available using the SiteStand mobile docking station. Audio recording only records system output.*

*Note: A separate video monitor, connected to the VCR, is required for viewing the recording.*



**To set up a recommended external video monitor:**

- 1** Connect a recommended video monitor to the system using the recommended video cable.  
The connector is on the left side of the system.  
There is one connection required: Video Out. See arrow labeled 4 in [Table 3, “System Connectors,” on page 54.](#)
- 2** Turn on the video monitor.  
Refer to the manufacturer’s instructions for specific video monitor information.

**To set up OB calcs authors:**

- 1** Press the Patient key.  
A menu appears on which is listed system setup.
- 2** Select system setup.  
A menu appears on which is listed video, printer/VCR, calcs, f keys.
- 3** Select video, printer/VCR, calcs, f keys.
- 4** Select calcs authors.  
A menu appears on which is listed the OB tables.
- 5** Select an author for each of the listed tables, see below:






**Table 4: Fetal Biometry by Calculation Author**

Tables (as they appear on the menu)	Calculation (calcs) Authors
BPD, FL, AC, HC, EFW:	Hadlock Hansmann Tokyo U. Osaka U. Chitty
GS:	Hansmann Nyberg Tokyo U.
CRL:	Hadlock Hansmann Tokyo U. Osaka U.

- 6** Press the Patient key to return to imaging.

### To set up function key assignments:

Function keys 1 through 6 can be assigned text for quick and easy labeling of images.

- 1 Press the Patient key. A menu appears on which is listed system setup.
- 2 Select system setup. A menu appears on which is listed video, printer/VCR, calcs, f keys.
- 3 Select video, printer/VCR, calcs, f keys.
- 4 Select function key assignment.  
A menu appears on which is listed function keys, f1 through f6.  
A flashing text entry cursor appears next to f1.
- 5 Type in your text. Use the Arrow keys   and Space key  to correct mistakes.
- 6 Press the Enter key  to move to the next field. Continue to assign text to the remaining function keys, as desired.
- 7 Select done  from the on-screen menu. (See [“Annotating Images” on page 72](#) for an explanation of how to use the assigned function keys.)

### To change all system setups to the default settings:

- 1 Turn the system off.
- 2 Connect the system to AC power, see [“Using AC Power” on page 41](#).
- 3 Simultaneously press and release 1 and the power switch.  
The system beeps several times and then the image display appears with all default settings.

### **WARNING:**

- An accurate date and time are critical for accurate obstetrics calculations. Verify that the date and time are accurate before each use of the system.
- 4 Reset the system settings, see [“Using System Setup” on page 51](#).

## Using the SiteStand® Mobile Docking Station

The SiteStand mobile docking station provides power, video, print, and image transfer capabilities for the system. You can tilt the system and adjust the height of the system when it is in the docking station. The docking station also has storage for two transducers, a tray for a recommended black-and-white printer, and a basket to hold other ultrasound accessories such as gel, wipes, and additional transducers. It provides the following connections: two video output, one audio output, an RS-232C, a printer or VCR control, and two power output, and one AC power input. The accessories to the SiteStand include a flat panel display, and a bracket for a VCR.

For more information, please refer to the *SonoSite SiteStand Mobile Docking Station User Guide*.

### SiteLink Image Manager Software

SiteLink Image Manager (SiteLink) software is available to use with your system. SiteLink allows you to transfer images from the SonoSite system to a host PC. The transfer is made by using the PC Direct serial cable from the I/O connector and the null-modem serial cable or by using the RS-232C connector on the SiteStand and the null-modem serial cable. For more information, please refer to the *SiteLink Image Manager User Guide*, which is available in PDF format on the SiteLink CD-ROM.

*Note: The PC Direct connect feature will not work when the SonoSite system is installed in the SiteStand.*

#### **CAUTION:**

- ▶ Healthcare providers who maintain or transmit health information are required by the Health Insurance Portability and Accountability Act of 1996 to implement appropriate procedures: to ensure the integrity and confidentiality of information; to protect against any reasonably anticipated threats or hazards to the security or integrity of the information or unauthorized uses or disclosures of the information.

### IrfanView Software

IrfanView software is provided with SiteLink. IrfanView allows you to view and manipulate images that have been transferred to the PC. For more information about IrfanView, please refer to the help files that are included in the software.

# .....Chapter 4: Imaging

## Preparing for the Exam

Connect a transducer and turn on the system as described in [Chapter 3, “Preparing the System”](#).

### **WARNING:**

- Verify that the patient information, date, and time settings are accurate.


The correct patient information helps identify saved, recorded, and printed images. You can edit patient information later in the exam by selecting current patient.

Selecting new patient later in the exam and entering patient information will erase any previously-entered information including any calculations and patient reports.

See [“Using System Setup” on page 51](#) for date and time setting instructions.

Applying acoustic coupling gel and installing a transducer cover are also covered in this chapter.

### **To enter patient information:**

- 1** Press the Patient key.  
A menu lists exam/patient information.
- 2** Select exam/patient information.  
A menu lists exam type, current patient, and new patient.  
*Note: Selecting new patient deletes the current patient report.*
- 3** Select new patient.  
A menu lists name, id, and accession; exam; and HR (bpm) or LMP.
- 4** Enter the name, id, and accession number, if applicable. (Press the Enter key  to move to the next field.)
- 5** Select exam to change the exam type.
- 6** Enter the HR (bpm) or LMP, if applicable.
- 7** Press the Patient key to return to live imaging.

### **To apply acoustic coupling gel:**

Acoustic coupling gel must be used during most exams. Although most gels provide suitable acoustic coupling, some gels are incompatible with some transducer materials.

#### **CAUTION:**

- ▶ Using gels not recommended for your transducer can damage it and void the warranty. If you have questions about gel compatibility, contact SonoSite or your local representative.

A sample of Aquasonic gel is provided with the system. Use gel for proper acoustic coupling.

Apply a liberal amount of gel between the transducer and the body.

### **To install a transducer cover:**

#### **WARNING:**

- ▶ If latex covers are used, refer to the FDA Medical Alert, dated March 29, 1991, Allergic Reactions to Latex-Containing Medical Devices.

SonoSite recommends the use of market-cleared, transducer covers for clinical applications of an invasive nature (such as transvaginal).

Because gel will be contained within the cover and between the cover and the transducer, install the cover only when you are ready to perform the procedure.

- 1 Place a quantity of gel inside the cover.
- 2 Insert the transducer into the cover.
- 3 Roll the cover over the transducer until the transducer is covered.
- 4 Secure the cover using the bands supplied with the cover.
- 5 Check for bubbles between the acoustic window of the transducer and the cover.

## **Transducer, Exam Type, and Imaging Mode**

#### **WARNINGS:**

- ▶ The SonoSite system has various configurations and options. All are described in this manual and may not apply to your system. System features are dependent on your configuration, transducer and exam type.
- ▶ The diagnostic capability differs for each transducer and exam type and imaging mode. Verify your system's capabilities prior to diagnosis.

The following table describes the transducer, exam type, imaging mode, and optimization that may be available on your system.

**Table 1: Transducer, Exam Type, and Imaging Mode**

Transducer	Exam Type	Imaging Mode		
		2D	CPD	DCPD
C60	OB	res, gen, pen	low, med, high	low, med, high
	Gyn	res, gen, pen	low, med, high	low, med, high
	Abdomen	res, gen, pen	low, med, high	low, med, high
C15	EC1	res, gen, pen		low, med, high
	EC2	res, gen, pen		low, med, high
	EC3	res, gen, pen		low, med, high
C15	Abdomen	res, gen, pen	low, med, high	
	OB	res, gen, pen	low, med, high	
	Chest	res, gen, pen		low, med, high
C11	Vascular	res, gen, pen	low, med, high	low, med, high
	Chest	res, gen, pen		low, med, high
	Neonatal	res, gen, pen	low, med, high	
	Abdomen	res, gen, pen	low, med, high	low, med, high
ICT	Gyn	res, gen, pen	low, med, high	
	OB	res, gen, pen	low, med, high	
	Prostate	res, gen, pen	low, med, high	
L38	Breast	res, gen, pen	low, med, high	
	Small Parts	res, gen, pen	low, med, high	
	Vascular	res, gen, pen	low, med, high	
HST	Vascular	res, gen, pen	low, med, high	
	Superficial	res, gen, pen	low, med, high	
	Muscles	res, gen, pen	low, med, high	

## 2D Imaging

The SonoSite system has advanced image optimization technology that greatly simplifies user controls. To achieve the best possible 2D image quality, it is important to properly adjust the display, gain, and depth settings. It is also important to select an optimization setting that best matches your needs.

The system has a high-performance, liquid crystal display (LCD). To optimize image quality, adjust the display for viewing angle, brightness, and contrast.

Refer to [Chapter 1, “Conventions Used in This User Guide” on page 2](#) to see how information is presented on-screen. Refer to [page 6](#) for the display and layout of the screen.

**To adjust the viewing angle of the display:**

The display is attached to a hinged joint that allows you to change the viewing angle. Adjust the viewing angle during the exam to achieve the best image quality.

Grasp the top of the display and rotate it up and toward you. Do not force the display beyond its maximum viewing angle.

**To adjust display brightness and contrast:**

The display controls are on the right side of the display with the Brightness control




- Increase brightness or contrast by pushing on the upper part of the corresponding control.
- Decrease brightness or contrast by pushing on the lower part of the corresponding control.
- In some cases when the system has been in use for an extended period and the display brightness is at the highest setting, the display brightness may return to a lower brightness setting. If this occurs, simply continue to adjust the brightness through its entire range of settings to select an appropriate brightness.

**To adjust gain:**

Turn near, far, or gain (on the left side of the display) to increase or decrease the amount of gain applied to the near field, far field, or the overall image (near and far correspond to the time gain compensation (TGC) controls found on other ultrasound systems).

**To adjust depth:**

Press the up Depth key  up to decrease or down to increase the displayed depth.


As you adjust the depth, the maximum depth number changes in the lower right corner of the screen.

*Note: The vertical depth scale is marked in 1 cm increments, larger marks are 5 cm increments.*

**To turn on 2D imaging:**


The system imaging default is 2D. Each time you turn the system on it begins imaging in 2D.

### To return to 2D imaging from another imaging mode:


Press the 0 key  for 2D.

*Note: If 2D does not come on, make sure the system is in live imaging.*




### To optimize the 2D image:

- 1 Press the Menu key  (to the left of Depth). A menu appears on the left side of the screen, which shows the optimization choices for the attached transducer.

*Note: Optimization choices change with transducer and exam type. [Table 1, “Transducer, Exam Type, and Imaging Mode,”](#) on page 61.*

- 2 Select the desired optimization  setting from the on-screen menu:
  - res provides the best possible resolution
  - gen provides a balance between resolution and penetration.
  - pen provides the best possible penetration.




### To change the image orientation:

- 1 Press the 0 key  for 2D.
- 2 Press the Menu key  (to the left of Depth).
- 3 Select orientation  from the on-screen menu.

*Note: Repeat step 3 for the desired orientation. There are four different orientations. An icon next to the on-screen menu displays the current orientation setting.*

### To turn on Tissue Harmonic Imaging (THI):

*Note: This is an optional feature and is dependent on transducer and exam type.*

- 1 Press the 0 key  to turn on 2D.
- 2 Press the Menu key  (to the left of the Depth key).
- 3 Select  from the on-screen menu and set it to [on].



### To zoom the image:

*Note: Zoom only works during real-time imaging. You cannot zoom a frozen or saved image.*

- 1 Press the Zoom key .


The image is magnified by a factor of two.

*Note: You can change the depth while the image is zoomed.*



- 2 Press the Zoom key  again to exit zoom.


### To freeze the image:


Press the Freeze key .


In 2D mode the cine icon  appears along the bottom section of the screen.

### To use cine review in 2D:

- 1 In Freeze mode, press the Cine Arrow keys   (directly above the Freeze key) to move through the cine review of the frozen image. Hold down a Cine arrow key to review the image at different points in time.

The position arrow moves along the cine icon , showing the relative position of the displayed image in the cine series.


- 2 Press the Freeze key  again to return to live imaging.

The cine icon  is removed from the bottom of the screen and live imaging begins.



## M-mode Imaging

The following instructions cover Motion mode (M-mode) imaging. Refer to “[2D Imaging](#)” on page 61 for instructions about the display, depth, and optimization.



### To turn on M-mode sample line:

- 1 Press the 9 key  for the M-mode sample line.  
*Note: If M-mode does not come on, make sure the system is in live imaging.*
- 2 Use the trackball to position the M-mode sample line over the image.  
*Note: Depth changes are not available in M-mode trace. Adjust the display depth prior to activating the M-mode trace.*


### To acquire M-mode trace:


- 1 Press the 9 key  again to acquire the M-mode trace.  
*Note: While viewing the trace, the M-mode sample line can be repositioned. A small reference image in the upper right corner of the screen, shows the position of the M-mode sample line.*  
*Note: The time scale at the top of the screen has small marks at 200 ms intervals and large marks at one second intervals.*
- 2 To return to the M-mode sample line, press the 9 key  again.

### To adjust M-mode sweep speed:





- 1 If the on-screen menu is not on, press the Menu key  (to the left of Depth).
- 2 Select sweep speed  from the on-screen menu to adjust the sweep speed to slow, med, or fast.

### To freeze the M-mode trace:


Press the Freeze key .

*Note: Press the 9 key again to display the associated frozen 2D image with the M-mode sample line. The cine icon  will appear at the bottom of the screen for this image. The position arrow moves along the cine icon, showing the relative position of the displayed image in the cine series. Press the 9 key again to display the frozen M-mode trace.*

### To use cine review in M-mode:

- 1 Press the Freeze key .
- 2 Press the Cine Arrow keys   (directly above the Freeze key) to move through the cine review of the frozen image. Hold down a Cine arrow key to review the image at different points in time.
- 3 Press the Freeze key  again to return to live imaging.

### To return to 2D imaging from M-mode:

Press the 0 key  for 2D.

## Color Power Doppler (CPD) or Directional Color Power Doppler (DCPD) Imaging

*Note: This is an optional feature and is dependent on transducer and exam type.*

The following instructions cover CPD and DCPD imaging. Refer to [“2D Imaging” on page 61](#) for instructions about the display, depth, freeze, zoom, and cine review.


### To turn on CPD or DCPD imaging:

- 1 Press the 8 key  for CPD or DCPD.

The on-screen menu item DCPD is only displayed if available for the transducer and exam type.

A Region of Interest (ROI) box is displayed in the center of the 2D image.

*Note: If CPD or DCPD mode does not come on, make sure the system is in live imaging.*

- 2 Press the Menu key  (to the left of Depth).
- 3 Select CPD or DCPD from the on-screen menu, if applicable.

or

Press the 8 key  again.




### To move the CPD or DCPD Region of Interest (ROI):

Use the trackball to move the ROI box. While you are moving the ROI box, you will see an outline of the new position moving on the display. When you stop moving, the new position will display the ROI box. (The size of the ROI box is fixed. There is no control to change it.)

### To adjust CPD or DCPD gain:

Turn the gain knob to increase or decrease the amount of CPD or DCPD gain. While in CPD or DCPD imaging, near and far knobs affect only the 2D image.

### To optimize the CPD or DCPD image:

- 1 Press the Menu key  (to the left of Depth).  
A menu appears which lists the optimization choices for the attached transducer. See [Table 1, “Transducer, Exam Type, and Imaging Mode,” on page 61](#) for the optimizing choices available by transducer.
- 2 Select the desired optimization  setting:
  - low optimizes the system for low flow states
  - med optimizes the system for medium flow states
  - high optimizes the system for high flow statesor  
Press the 8 key  again for CPD or DCPD.

### To return to 2D imaging from CPD or DCPD imaging:


Press the 0 key  for 2D.

## Pulsed Wave (PW) and Continuous Wave (CW) Doppler Imaging

*Note: This is an optional feature and is dependent on transducer, exam type, and hardware configuration.*






The following instructions cover pulsed wave (PW) or continuous wave (CW) Doppler imaging. Refer to [“2D Imaging” on page 61](#) for instructions about the display, depth, and freeze.

### To turn on the Doppler sample line:

- 1 Press the 7 key  for the Doppler sample line.  
The Doppler sample line appears on the screen


*Note: If PW or CW Doppler mode does not come on, make sure the system is in live imaging.*

On-screen menu options for Doppler sample:


-  Angle correction (PW only)
-  Gate Size (PW only)
-  Steering (L38 transducer only)
-  [PW] CW
-  Done

- 2 Select PW or CW from the on-screen menu, as required.

### To adjust the angle correction (PW Doppler only):


- 1 Select angle correction  from the on-screen menu.
- 2 Move the trackball left or right to adjust the angle in two degree increments from -74 to +74 degrees.
- 3 Select angle correction again to set the angle.

### To adjust the gate size (PW Doppler only):

- 1 Select gate size  from the on-screen menu.
- 2 Repeat the step above for the desired gate size.

*Note: Gate size options vary with transducer and exam type.*

### To adjust the steering (L38 transducer only):

Select steering  from the on-screen menu.

This automatically changes the angle correction to the optimum setting. See table below:

**Table 2: Steering Selection and Angle Correction**


Steering Selection (Degrees)	Angle Correction (Degrees)
-15	-60
0	0
+15	+60

*Note: The angle correction can be adjusted manually after steering has been selected. (See “To adjust the angle correction”.)*

### To acquire Doppler spectral trace:

- 1 Use the trackball to position the Doppler sample line over the image.






*Note: Depth changes are not available in the Doppler trace. Adjust the display depth prior to activating the Doppler trace (step 2).*

- 2 Press the 7 key  again to view the PW or CW Doppler spectral trace.


*Note: While viewing the trace, the Doppler sample line can be repositioned. A small reference image in the upper right corner of the screen, shows the position of the Doppler sample line.*

*Note: The time scale at the top of the screen has small marks at 200 ms intervals and large marks at one second intervals.*


On-screen menu options for Doppler spectral trace:

-  Pulse Repetition Frequency or Scale
-  Baseline position
-  Invert image
-  Next menu
-  Done

### To adjust pulse repetition frequency:

Select pulse repetition frequency  from the on-screen menu to adjust the pulse repetition frequency of the Doppler spectral trace.

### To adjust baseline:

Select baseline position  from the on-screen menu to adjust the baseline.

*Note: Baseline can be adjusted on a frozen trace.*

*Note: When you adjust the baseline on a frozen image, the Doppler spectral trace may shift.*

*Note: Use the Cine Arrow keys   (directly above the Freeze key) to adjust to the desired position.*

### To adjust invert:




Select invert  from the on-screen menu to vertically flip the spectrum.

*Note: Invert can be adjusted on a frozen trace.*




*Note: When you adjust the invert on a frozen image, the Doppler spectral trace may shift.*

*Note: Use the Cine Arrow keys   (directly above the Freeze key) to adjust to the desired position.*

### To adjust wall filter:

- 1 Select next  to display the on-screen options.
- 2 Select wall filter  from the on-screen menu to adjust the filtering to low, med, or high.
- 3 Select done  from the on-screen menu to go back to the previous menu.

### To adjust sweep speed:

- 1 Select next  to display the on-screen options.
- 2 Select sweep speed  from the on-screen menu to adjust the trace speed to slow, med, or fast.
- 3 Select done  from the on-screen menu to go back to the previous menu.

### To adjust Doppler volume:

Turn the near knob to increase or decrease the Doppler speaker volume.

### To adjust Doppler gain:


Turn the gain knob to increase or decrease the amount of Doppler gain.

### To change the Doppler scale:

- 1 Press the Patient key.  
A menu appears on which system setup is listed.
- 2 Select system setup.  
A menu appears on which is listed OCR, TI, picto, Doppler.
- 3 Select OCR, TI, picto, Doppler.
- 4 Select Doppler Scale.
- 5 Select Doppler Scale again to set scale to cm/s or kHz.
- 6 Press the Patient key to return to live imaging.





### To freeze the Doppler image:

- 1 Press the Freeze key .

*Note: Press the 7 key again to display the associated frozen 2D image with the Doppler sample line. The cine icon  will appear at the bottom of the screen for this image. The position arrow moves along the cine icon, showing the relative position of the displayed image in the cine series.*

- 2 Press the 7 key again to display the frozen Doppler image.

### To use cine review in Doppler:

- 1 Press the Freeze key .
- 2 Press the Cine Arrow keys   (directly above the Freeze key) to move through the cine review of the frozen trace. Hold down a Cine arrow key to review the image at different points in time.
- 3 Press the Freeze key  again to return to live imaging.

### To return to 2D imaging from Doppler:

Press the 0 key  for 2D.

## ECG Monitoring

*Note: This option requires a SonoSite ECG cable.*

### **WARNINGS:**

- ▶ To prevent misdiagnosis, do not use the ECG trace to diagnosis cardiac rhythms. The SonoSite ECG option is a non-diagnostic feature.
- ▶ To prevent misdiagnosis, do not use the SonoSite ECG option for long term cardiac rhythm monitoring.

### **CAUTION:**




- ▶ Use only accessories recommended by SonoSite with the system. Your system can be damaged by connecting an accessory not recommended by SonoSite.

### To turn on ECG monitoring:

Connect the ECG Cable to the I/O connector located on the left side of the SonoSite unit (refer to [Table 3, “System Connectors,” on page 54](#)).

*Note: When the ECG cable is connected, ECG monitoring turns on automatically.*











### To optimize the ECG monitoring trace:

- 1 Press the 0 key  to turn on 2D.
- 2 Press the Menu key  (to the left of Depth).
- 3 Select  ECG... from the on-screen menu for the ECG controls.

*Note: This menu option appears only when the ECG cable is connected.*









On-screen menu options for ECG:

-  Increase ECG gain
  -  Decrease ECG gain
  -  ECG position
  -  Sweep speed
  -  Done
- 4 Select the on-screen   to adjust the ECG gain to achieve the best trace image.
  - 5 Select ECG position  to change the ECG monitoring trace to a desired location on the screen.
  - 6 Select sweep speed  from the on-screen menu to adjust the trace speed to slow, med, or fast.
  - 7 Select done  from the on-screen menu to go back to the 2D menu.

## Annotating Images



*Note: You can only enter annotation in one row across the top of a frozen image. You cannot move text on the image display.*

### To enter text:

- 1 Press the Freeze key .
- 2 Press the Text/Picto key.  
A flashing data entry cursor appears in the upper left corner.
- 3 Use the keyboard to enter, delete, or modify text:
  - Press the Backspace key  to delete characters to the left of the cursor.
  - Press the Space key to add spaces between words or replace characters with blank spaces to the right of the cursor.
  - Press the Arrow keys   (between the Backspace and Enter keys) to move the cursor to the left or right.
  - Press the Enter key  to return the cursor to the beginning of the line of text.
  - Select delete  from the on-screen menu to remove all of the text entered.
  - Press the Cap key to capitalize text, or press the Shift key followed by the key you want to capitalize.
- 4 Press the Text/Picto key to turn off text entry.




### To use the arrow icon:

Use the arrow as a pointer to bring attention to a specific part of the image.



- 1 Press the Text/Picto key.
- 2 Select arrow  from the on-screen menu to activate it.
- 3 Use the trackball to move the arrow over the image.
- 4 Press the Select key and use the trackball to change the arrow's direction. Then press Select again.
- 5 To remove the arrow from the screen, select arrow  again from the on-screen menu.

### To label the display with pre-defined text:

See [Chapter 3, "To set up function key assignments:"](#) on page 57, if necessary.


- 1 Press the Freeze key .
- 2 Press the Text/Picto key.  
A flashing data entry cursor appears in the upper left corner of the image display.
- 3 Press the Function  key.
- 4 Press a numeric key (1 through 6) corresponding to the assigned text with which you want to label the display. Entering assigned text removes any other labeling on the display.  
Select delete  from the on-screen menu to remove assigned text.

### To display a pictograph and transducer marker for non-biopsy capable transducers:

- 1 To turn on the picto icon , press the Patient key and select system setup from the on-screen menu.
- 2 Select OCR, TI, picto, Doppler.
- 3 Select pictograph from the on-screen menu and set it to [on].
- 4 Press the Patient key. A pictograph now appears in the upper right corner of the screen.  
*Note: The pictograph displayed depends on the transducer and exam type.*
- 5 Press the Freeze key .
- 6 Press the Text/Picto key.

A flashing data entry cursor appears in the upper left corner of the image display and along with the following menu options:



-  Arrow
-  Delete
-  Picto

- 7** Select picto  from the on-screen menu to display the next pictograph in the series for exam type.

Each time you select picto  from the on-screen menu:


- The ratio next to the icon changes to show which pictograph in a set of pictographs has been selected. For example 2/10 shows that there are 10 pictographs for this transducer and exam type, and the second pictograph has been selected from the 10 available pictographs.
  - A different pictograph is displayed in the upper right corner of the screen for each transducer and exam type combination.
- 8** Use the trackball to position the transducer marker over the pictograph. The dot on one end of the transducer marker should correspond to the orientation marker in the displayed image.
- 9** Press the Select key and use the trackball to rotate the transducer marker to the proper angle.
- 10** If necessary, press Select again and use the trackball to reposition the transducer marker.




### **To display a pictograph and transducer marker for biopsy capable transducers:**


- 1** To turn on the picto , press the Patient key and select system setup from the on-screen menu.
- 2** Select OCR, TI, picto, Doppler.
- 3** Select pictograph from the on-screen menu and set it to [on].
- 4** Press the Patient key. A pictograph now appears in the upper right corner of image display.
- 5** Press the Freeze key .
- 6** Press the Text/Picto key.

A flashing data entry cursor appears in the upper left corner of the image display and along with the following menu options:

-  Arrow
-  Delete
-  Next Menu


**7** To display the second menu, select next  from the on-screen menu. The following menu appears:

-  Biopsy
-  Picto
-  Done

**8** Select picto  from the on-screen menu to display the next pictograph in the series for exam type.

Each time you select picto  from the on-screen menu:

- The ratio next to the icon changes to show which pictograph in a set of pictographs has been selected. For example 2/10 shows that there are 10 pictographs for this transducer and exam type, and the 2nd pictograph has been selected from the 10 available pictographs.
- A different pictograph is displayed in the upper right corner of the screen for each transducer and exam type combination.

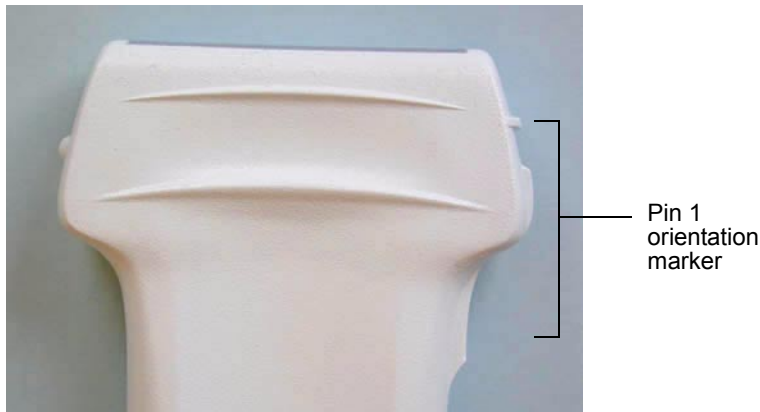
**9** When picto  has been selected, use the trackball to position the transducer marker. The dot on one end of the transducer marker should correspond to the orientation marker in the displayed image.

**10** Press the Select key then use the trackball to rotate the transducer marker to the proper angle.

**11** If necessary, press the Select key again and use the trackball to reposition the transducer marker.

**12** Select done  from the on-screen menu to return to the previous menu.

L38/10-5  
transducer



## Using the Biopsy Guideline Display




*Note: When the ICT/7-4 MHz, L38/10-5 MHz, or C60/5-2 MHz transducers are connected to the system, the biopsy guideline display features are available.*

The image of an anatomical target, biopsy guidelines that represent the anticipated path of the biopsy needle, a transducer marker, and a biopsy needle are displayed on the LCD to assist in guiding the biopsy needle to the target. For detailed instructions on the use of the system and biopsy guide accessories, and a list of compatible transducers, please refer to the *Biopsy User Guide*.

## Printing Images

Ensure the printer is properly setup for operation with the system. See [Chapter 3](#), “[To set up a recommended printer:](#)” on page 53.

### To print an image:

- 1 Press the Freeze key .
- 2 Press the Print/VCR key  or Print key  to print images.

### To print all images:



- 1 Save the images. (See “[To save an image:](#)” on page 77.)
- 2 Press the Patient key.  
A menu appears on which is listed stored images.
- 3 Select stored images from the on-screen menu.
- 4 Select print all images from the on-screen menu. All images print.

### To cancel printing:

Press the Freeze key  to stop printing.

## Saving and Reviewing Images

### To save an image:

- 1 Press the Freeze key .
- 2 Press the Save key .





The image memory icon in the lower right section of the screen changes to show the image was saved.


The number above the memory icon increases by 1 to show how many images have been saved. Depending on your configuration, you may be able to save up to 119 images in memory.







### To review or delete individual images:

- 1 Press the Patient key.  
A menu appears on which is listed stored images.
- 2 Select stored images from the on-screen menu.  
A menu appears on which is listed review images.
- 3 Select review images.


The last saved image appears with following menu:

-  Next image
-  Previous image
-  Delete
-  Done

*Note: Press the Menu key  (to the left of Depth) to turn off or turn on this menu.*

- 4 Use the cine arrow keys from the on-screen menu or the Cine arrow keys   (above Freeze) or the Arrow keys   (next to the Enter key) to review the images.
- 5 Select delete  from the on-screen menu to remove the displayed image from the memory.
- 6 A confirmation dialog appears and a menu on which is listed yes or no.
- 7 Select yes to delete the image, or select no to cancel.
- 8 When you are done, press the Freeze key  to return to the menu.
- 9 Press the Patient key to return to live imaging.

#### **To delete all saved images:**

- 1 Press the Patient key.  
A menu appears on which is listed stored images.
- 2 Select stored images from the on-screen menu.  
A menu appears on which is listed delete all images.
- 3 Select delete all images from the on-screen menu.  
A confirmation dialog appears and a menu on which is listed yes or no.
- 4 Select yes to delete all images, or select no to cancel the operation.
- 5 Select done  from the on-screen menu until you return to live imaging.

## Recording Images



*Note: This feature is dependent on the hardware configuration.*

Ensure the VCR is properly setup for operation with the system. See [Chapter 3, “To set up the recommended VCR:”](#) on page 55.

### **CAUTIONS:**

- ▶ The VCR must be selected in the system setup to use the Print/VCR key to begin recording and to stop recording. It is recommended that if you are connecting a VCR and a printer, use the remote control to run the printer.
- ▶ To prevent recording over images stored on a VCR videotape, make sure the proper peripheral is selected in system setup. With a VCR connected, the VCR will begin recording when the black and white (B&W) printer is selected in system setup. The only way to stop the VCR recording is to use the controls on the VCR.

### **To start and stop the VCR:**

- 1 Press the Print/VCR key  or use the controls on the VCR to start VCR recording.  
A dynamic VCR recording icon  in the right section of the system display indicates that the VCR is recording.
- 2 Press the Print/VCR key a second time or use the controls on the VCR to stop recording.

*Note: If dynamic VCR recording icon does not appear, the VCR is not recording. To ensure proper recording, check:*

- *Print/VCR key selection is set to Sony VCR (see [page 55](#))*
- *Cables connected properly*
- *Using recommended VCR*
- *VCR power on*

Refer to the VCR manufacturer's instructions for recording and other functions.



## After the Exam

You should check the battery after each use to ensure adequate charge is available for the next exam.

**CAUTION:**

- ▶ SonoSite recommends that you clean transducers after each use. Continual, long-term exposure to gel can damage transducers. Refer to [Chapter 6, “Troubleshooting and Maintenance”](#) for cleaning and disinfecting procedures.

# Chapter 5: Measurements and Calculations

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## Measurements

Measurements and calculations are performed on frozen images. The following steps explain how to perform basic measurements in each imaging mode. Based on measurements taken, the SonoSite system automatically performs specific calculations and displays the results.

### 2D Measurements






The basic measurements that can be performed in 2D are:

- Distance
- Area (ellipse)
- Circumference (ellipse)


#### To perform a distance measurement:

- 1 On a frozen 2D image, press the Measure key.

Two calipers appear on-screen and the following menu options:


-  First caliper set
-  Second caliper set
-  Ellipse (circumference/area)
-  Delete
-  Calculations (calcs)

*Note: The two calipers are connected by a dotted line. The first caliper in the menu is active. When the calipers get farther apart, they increase in size; when the cursors get closer together, they decrease in size. The caliper line disappears as the calipers get closer together.*


- 2 Use the trackball to position the first caliper .
- 3 Press the Select key to activate the second caliper.
- 4 Use the trackball to position the second caliper.

*Note: The results update next to the caliper icon as you move the caliper, and the measurement is complete when you finish moving the calipers.*

### To perform a second distance measurement:

- 1 Select the second set of calipers  from the on-screen menu.  
This will add another set of calipers to the image.
- 2 Use the trackball and Select key as described in the preceding steps to complete the second measurement.


### To perform an ellipse measurement (area and circumference):

- 1 Perform a distance measurement.
- 2 Select ellipse  from the on-screen menu.  
The circumference and the area appear in the lower left section of the screen.
- 3 Use the trackball to adjust the size of the ellipse.
- 4 Press the Select key to adjust the first caliper. Press Select again to adjust the second caliper.

*Note: The results continue to update as the size is changed. The measurement is complete when you have finished adjusting the axes and position of the ellipse.*

*Note: When an ellipse measurement is performed, only one distance measurement is available.*


### To turn off the ellipse:

Select ellipse  again from the on-screen menu.

### To delete a measurement:

- 1 Select the first set of calipers  or the second set of calipers .
- 2 Select delete  from the on-screen menu.

### To exit measurements:

Press the Freeze key  to return to live imaging and exit measurements.

## M-mode Measurements

The basic measurements that can be performed in M-mode are:





- Distance (cm)
- Time (seconds)
- Heart Rate (bpm)


*Note: The time scale at the top of the screen has small marks at 200 ms intervals and large marks at one second intervals.*

### To perform a distance measurement:

- 1 On a frozen M-mode trace, press the Measure key.

A single caliper appears on-screen with the following menu options:

-  Caliper set
-  Heart Rate menu
-  Delete
-  Calculations (calcs)

- 2 Use the trackball to position the caliper .

- 3 Press the Select key.

A second caliper appears on the screen.

- 4 Use the trackball to position the second caliper.

The distance and time measurements are displayed in the upper left section of the screen.


*Note: The results update next to the caliper icon as you move the caliper, and the measurement is complete when you finish moving the calipers.*

### To delete the active measurement:



Select delete  from the on-screen menu.

This will remove the active set of calipers from the screen.


### To measure heart rate:


- 1 On a frozen M-mode trace, press the Measure key.
- 2 Select heart rate  from the on-screen menu.

A vertical caliper appears as a dotted line on-screen with the following menu options:

  -  Save
  -  Done
- 3 Move the trackball right or left to position the first vertical caliper at the peak of the heart beat.
- 4 Press the Select key.

A second vertical caliper appears on the screen.
- 5 Move the trackball right to position the second vertical caliper at the peak of the next heart beat.

The heart rate (bpm) measurement is displayed in the upper left section of the screen.
- 6 Select save  from the on-screen menu to save the heart rate measurement to the patient report.

*Note: This will overwrite the previous heart rate value entered under exam/patient information or the one measured in PW or CW Doppler. See “Preparing for the Exam” on page 59.*
- 7 Select done  from the on-screen menu to go back to basic measurements.

### Doppler Measurements—Pulsed Wave (PW) and Continuous Wave (CW)






*Note: The Doppler scale must be set to cm/s for the following measurements. See Chapter 3, “Using System Setup” on page 51.*

The basic measurements that can be performed in PW and CW Doppler are:

- Acceleration (ACC)
- Elapsed Time (ET)
- Pressure Gradient (PGr), Cardiac exam type only: Chest, EC1, EC2, EC3
- Resistive Index (RI)
- Velocity
- Ratio of two velocities (+/× or Systolic/Diastolic [S/D])









## To measure a velocity (cm/s) and pressure gradient (PGr) in Doppler mode:

*Note: Pressure Gradient (PGr) in exam type cardiac only: Chest, EC1, EC2, EC3.*

- 1 On a frozen Doppler spectral trace, press the Measure key.  
A single caliper appears on-screen with the following menu options:
  -  First caliper
  -  Second caliper
  -  Automatic/manual trace
  -  Delete
  -  Calculations (calcs)
- 2 Use the trackball to position the active caliper to the peak systolic wave form. (This is a single caliper from the baseline).  
The velocity measurement is displayed in the upper left section of the screen.  
The Pressure Gradient (PGr) value is displayed in the lower left section of the screen.

## To measure two velocities, resistive index (RI), +/x or S/D ratio, acceleration, and elapsed time:

*Note: RI and +/x or S/D ratio available in all modes except cardiac imaging.*

- 1 On a frozen Doppler spectral trace, press the Measure key.  
A single caliper appears on-screen with the following menu options:
  -  First caliper
  -  Second caliper
  -  Automatic/manual trace
  -  Delete
  -  Calculations (calcs)
- 2 Use the trackball to position the first caliper  to a peak systolic wave form.
- 3 Press the Select key or select the second caliper  from the on-screen menu.  
A second caliper appears on the screen.
- 4 Use the trackball to position the second caliper  at end diastole on the wave form.

A measurement taken with the second caliper provides a second velocity. The velocity measurements are displayed in the upper left section of the screen. When two velocity measurements are taken, RI,  $+/\times$  or S/D ratio, acceleration, and elapsed time are displayed in the lower left section of the screen.

*Note: The results continue to update as the caliper positions are changed. The measurement is complete when you have finished adjusting the position of the calipers.*

- 5** Press the Save  key to save the image.

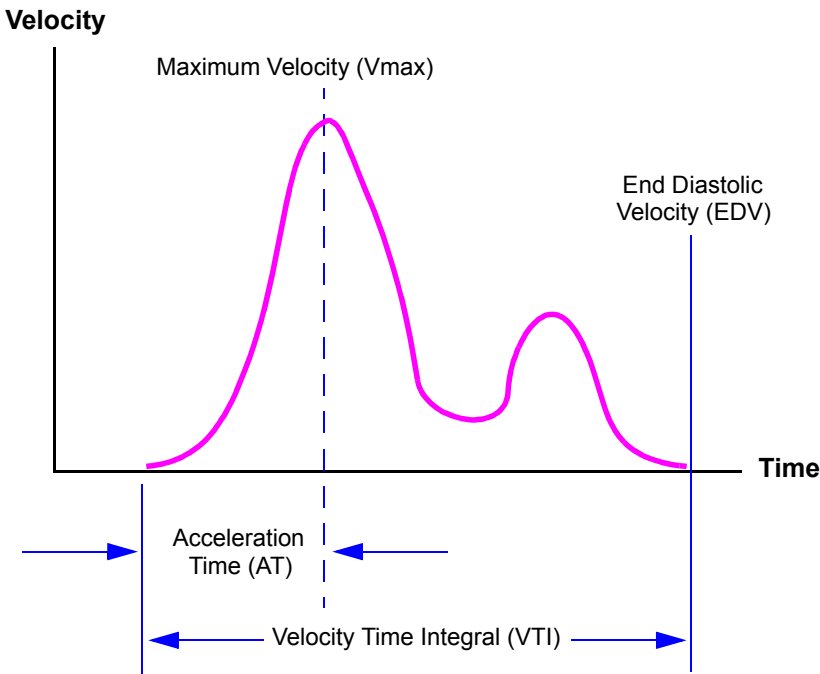
Pressing the Save key will save the image but will not enter the results to the patient report.

The following table shows the trace results displayed by exam type:

**Table 1: Trace Calculations by Exam Type**

	Cardiac	Vascular	OB/Gyn	Abdominal and Other
Velocity Time Integral (VTI)	x			
Maximum Velocity (Vmax)	x	x	x	x
Mean Pressure Gradient (PGmean)	x			
Mean Velocity on Peak Trace (Vmean)	x			
Maximum Pressure Gradient (PGmax)	x			
Time Average Mean on Mean Trace (TAM)*				x
+/- or Systolic/Diastolic (S/D)		x	x	x
Pulsatility Index (PI)		x	x	x
End Diastolic Velocity (EDV)		x		
Acceleration Time (AT)	x			x
Resistive Index (RI)		x	x	x






*Note: The automatic trace tool must be used to calculate the TAM.\**





**Figure: Trace Calculations of the Doppler Wave Form**





### To perform a manual trace in PW or CW Doppler:



- 1 On a frozen Doppler spectral trace, press the Measure key.
- 2 Select trace  from the on-screen menu.  
*Note: The system defaults to manual trace or to the last trace method selected.*
- 3 Select manual trace  from the on-screen menu.  
A single caliper appears on the screen. This caliper is used to mark points on the trace.
- 4 Position the caliper at the beginning of the desired wave form, and press Select.  
*Note: If calipers are not placed in the correct position, the calculation will not be performed accurately. See [figure “Trace Calculations of the Doppler Wave Form” on page 87](#).*
- 5 Use the trackball to move the caliper to the next desired point on the wave form.
- 6 Continue marking points to complete the trace.  
The last point must be placed at the end of the wave form.  
*Note: If an error is made, use the backspace key to delete the previous position.*
- 7 Select SET  from the on-screen menu to complete the trace and to display the results.
- 8 Press the Save key  to save an image of the trace with the results displayed.  
If needed, select hide  from the on-screen menu to remove the calculations, then press the Save key to save an image of the trace without the results displayed.




### To hide or show calculations in an automatic or manual trace:

Select Hide  from the on-screen menu to remove the calculations from the screen or select Show  from the on-screen menu to display the calculations on the screen.



Pressing done  will remove the results. Pressing the Save key  will save the image but will not enter the results to the patient report.



### To perform an automatic trace in PW or CW Doppler:

- 1 On a frozen Doppler spectral trace, press the Measure key.
- 2 Select trace  from the on-screen menu.
- 3 Select automatic trace  from the on-screen menu.  
A vertical caliper appears on the screen.

- 4 Use the trackball to position the first vertical caliper at the beginning of the wave form.
- 5 Press the Select key.  
*Note: If calipers are not placed in the correct position, the calculation will not be performed accurately. See figure “Trace Calculations of the Doppler Wave Form” on page 87.*  
A second vertical caliper appears on the screen.
- 6 Use the trackball to position the second vertical caliper at the end of the wave form.
- 7 Select SET  from the on-screen menu to complete the trace and to display the results.
- 8 Press the Save key  to save an image of the trace with the results displayed. If needed, select hide  from the on-screen menu to remove the calculations, then press the Save key to save an image of the trace without the results displayed.

**To hide or show calculations in an automatic or manual trace:**

Select Hide  from the on-screen menu to remove the calculations from the screen or select Show  from the on-screen menu to display the calculations on the screen.

Pressing done  will remove the results. Pressing the Save key  will save the image but will not enter the results to the patient report.

# Calculations

## WARNINGS:

- Verify that the patient information, date, and time settings are accurate. See [Chapter 3](#), if necessary.
- Before starting a new calculation, start a new patient record to delete the previous measurements. See [“Preparing for the Exam” on page 59](#).

## Volume Calculation

The following table shows the transducers and exam types that provide a volume calculation.

**Table 2: Transducers and Exam Types**

Transducer	Exam Types for Volume
C60	OB, Gyn, Abdomen
C15	Abdomen, OB
C11	Vascular, Neonatal, Abdomen
ICT	Gyn, OB, Prostate
L38	Breast, Small Parts, Vascular


The following table shows the measurements required to complete the volume calculation. Volume measurements are completed in 2D mode.



**Table 3: Volume Calculation**

Measurement	Calculation Result
D <sup>1</sup> D <sup>2</sup> D <sup>3</sup> (2D distance)	Vol (Volume)


## To perform a volume calculation:

### WARNING:


- Verify that the patient information, date, and time settings are accurate.
- 1 On a frozen 2D image, press the Measure key.
- 2 Select calcs  from the on-screen menu.
- 3 Select volume from the on-screen menu. (In OB and Gyn, select AFI Volume.)  
A list of measurements (D<sup>1</sup> D<sup>2</sup> D<sup>3</sup>) appear in the lower left section of the screen with the active measurement result shown directly above.  
In OB and Gyn, the volume measurements (D<sup>1</sup> D<sup>2</sup> D<sup>3</sup>) appear after the quadrant measurements, Q<sup>1</sup>Q<sup>2</sup>Q<sup>3</sup>Q<sup>4</sup>.

- 4 Press the Arrow keys ◀ ▶ (next to the Enter key) for the desired measurement.
- 5 Perform the distance measurement.
- 6 Select save  from the on-screen menu, or press the Enter key  to save the measurement to the patient report.



The saved measurement is shown in the upper left section of the screen, and a check mark is put in front of the measurement at the bottom of the screen.

- 7 Press the Save key  to save the image with measurements to memory. (optional)

*Note: Save the image with the measurements and calculation results before proceeding to the next calculation measurement.*



- 8 Press the Arrow keys ◀ ▶ for the next distance measurement in the calculation.
- 9 Repeat these steps until all measurements have been completed.
- 10 Select calcs  from the on-screen menu to return to the list of calculations and patient report.

See “[Viewing Patient Report](#)” on page 112.

- 11 Press done  from the on-screen menu and then the Freeze key  to return to live imaging.

*Note: This must be done to turn calculations off, otherwise it remains on.*

### **To view or repeat a saved measurement:**

- 1 Use the Arrow keys ◀ ▶ (next to the Enter key) to select the measurement. The previously saved measurement results will appear in the upper left section of the screen.
- 2 Repeat the measurement. The new results appear directly above the measurement. You can compare the active measurement to the saved measurement.
- 3 To save the new measurement, select save  from the on-screen menu, or press the Enter key .

*Note: This will save the new measurement to the patient report and overwrite the previously saved measurement.*

**To delete a measurement:**

- 1 Use the Arrow keys (◀ ▶) (next to the Enter key) to select the measurement.
- 2 Select delete (✕) from the on-screen menu.  
This will remove the measurement from the screen and the patient report.

**Volume Flow Calculation**

The following table shows the transducers and exam types that provide a volume flow calculation.

**Table 4: Transducer and Exam Types**

Transducer	Exam Types for Volume Flow
C60	Abdomen
C15	Abdomen
C11	Vascular/ Abdomen
L38	Vascular

The following table shows the measurements required to complete the volume flow calculation.

**Table 5: Volume Flow Calculation**

Measurement	Calculation Result
D (2D distance)	VF (Volume Flow)
TAM (Doppler trace)	

Volume flow measurements are done in 2D and Doppler. Both measurements are required for the volume flow calculation. The Doppler sample volume should completely insonate the vessel.

*Note: The following factors should be considered when acquiring volume flow measurements:*

- *Users should follow current medical practice for volume flow calculation applications.*
- *The accuracy of the volume flow calculation is largely dependent on the user.*
- *The factors identified in the literature that affect the accuracy are:*
  - *Using the diameter method for 2D area*
  - *Difficulty ensuring uniform insonation of the vessel—The SonoSite system is limited to sample volume sizes of 1, 2, 3, and 5 mm, depending on the transducer and exam type.*
  - *Precision in placing the caliper*
  - *Accuracy in angle correction*




The considerations and degree of accuracy for volume flow measurements and calculations are discussed in the following reference:  
Allan, Paul L. et al. *Clinical Doppler Ultrasound*, 4th Edition, Harcourt Publishers Limited. 2000, pp. 36-38.

### **To perform a volume flow calculation:**




#### **WARNING:**

- Verify that the patient information, date, and time settings are accurate.

#### **2D measurement:**







- 1 On a frozen 2D image, press the Measure key.
- 2 Select calcs  from the on-screen menu.
- 3 Select volume flow from the on-screen menu.
- 4 Perform the distance measurement.
- 5 Select save  from the on-screen menu, or press the Enter key  to save the measurement to the patient report.

The saved measurement is shown in the upper left section of the screen, and a check mark is put in front of the measurement at the bottom of the screen.

- 6 Select calcs  from the on-screen menu to return to the list of calculations and the patient report.
- 7 Press done  from the on-screen menu and then the Freeze key  to return to live imaging.



*Note: This must be done to turn calculations off, otherwise it remains on.*

#### **Doppler measurement:**

- 1 On a frozen Doppler spectral trace, press the Measure key.
- 2 Select calcs  from the on-screen menu.
- 3 Select volume flow from the on-screen menu.
- 4 Perform an automatic trace. See [“To perform an automatic trace in PW or CW Doppler:” on page 88.](#)
- 5 Select save  from the on-screen menu, or press the Enter key  to save the measurement to the patient report.
- 6 Select calcs  from the on-screen menu to return to the list of calculations and patient report.  
See [“Viewing Patient Report” on page 112.](#)
- 7 Press done  from the on-screen menu and then the Freeze key  to return to live imaging.


*Note: This must be done to turn calculations off, otherwise it remains on.*

**To view or repeat a saved measurement:**

- 1** Use the Arrow keys ◀ ▶ (next to the Enter key) to select the measurement.  
The previously saved measurement results will appear in the upper left section of the screen.
- 2** Repeat the measurement.  
The new results appear directly above the measurement. You can compare the active measurement to the saved measurement.
- 3** To save the new measurement, select save  from the on-screen menu, or press the Enter key .

*Note: This will save the new measurement to the patient report and overwrite the previously saved measurement.*

**To delete a measurement:**

- 1** Use the Arrow keys ◀ ▶ (next to the Enter key) to select the measurement.
- 2** Select delete  from the on-screen menu.  
This will remove the measurement from the screen and the patient report.

# OB Calculations

References for these measurements and calculations are located in [Chapter 8, “References”](#).

The following table shows the transducers and exam types that provide OB calculations.

**Table 6: Transducer and Exam Types**

Transducer	Exam Type
C60	OB, Gyn
C15	OB
ICT	Gyn, OB

**WARNING:**

- Make sure you have selected the OB or Gyn exam type and the OB calcs author for the OB table you intend to use. See [Table 7, “OB Calculations,” on page 96](#).

To select the calculation author See [“Using System Setup” on page 51](#), if necessary.

If you change the calc author during the exam, the common measurements are retained.

For EDD by LMP calculation, make sure to enter the LMP (last menstrual period) date in exam/patient information. See [“Preparing for the Exam” on page 59](#).



The following table shows the measurements required to complete the desired OB calculation. OB measurements are done in 2D mode.

**Table 7: OB Calculations**

Calculation Result	OB Measurements	Calculation Authors
Estimated Fetal Weight (EFW) (See note 1)	AC, FL	Hadlock 1
	BPD, AC, FL	Hadlock 2
	HC, AC, FL	Hadlock 3
	BPD, TTD	Hansmann
	BPD, FTA, FL	Osaka U.
	BPD, TTD, APTD, FL	Tokyo U.
Fetal Age (See note 2)	BPD, HC, AC, FL	Hadlock
	BPD, OFD, HC, AC, TTD, FL	Hansmann
	BPD, FTA, FL	Osaka U.
	BPD, AC, FL	Tokyo U.
	BPD, HC, AC, FL	Chitty
	CRL	Hadlock
		Hansmann Tokyo U. Osaka U.
	GS (GS <sup>1</sup> , GS <sup>2</sup> , GS <sup>3</sup> )	Hansmann Nyberg Tokyo U.
Average Ultrasound Age (AUA)	(See note 3)	
Amniotic Fluid Index	Q <sup>1</sup> , Q <sup>2</sup> , Q <sup>3</sup> , Q <sup>4</sup>	Jeng
Volume	D <sup>1</sup> , D <sup>2</sup> , D <sup>3</sup>	Beyer

*Note 1: The Estimated Fetal Weight calculation uses an equation that consists of one or more fetal biometry measurements. The author for the OB tables, which you choose in system setup, determines the measurements you must perform to obtain an EFW calculation. See Chapter 3, “Using System Setup” on page 51, if necessary.*


*Note 2: The fetal age is automatically calculated and displayed next to the OB measurement you selected. The average of the measurements taken is the AUA.*

*Note 3: The system does not perform averaging of multiple measurements of the same anatomy. For example: if you measure femur length twice, the second measurement replaces the first and appears in the patient report, not the average of the two measurements.*



## To perform OB measurements:

### WARNING:



► An accurate date and time are critical for accurate obstetrics calculations. Verify that the date and time are accurate before each use of the system. The system does not automatically adjust for daylight savings time changes.

- 1 Select OB or Gyn exam type, and enter the LMP in the patient information.
- 2 On a frozen 2D image, press the Measure key.
- 3 Select calcs  from the on-screen menu.


If you change the calc author during the exam, reselect the desired calculation/label to reset the calculations/labels for the new author. The common measurements are retained.

- 4 Select the desired OB calculation package from the on-screen menu.  
A list of measurements appear in the lower left section of the screen with the active measurement result shown directly above.
- 5 Press the Arrow keys   (next to the Enter key) for the desired measurement.
- 6 Perform the measurement.




See “To perform a distance measurement:” on page 81 and “To perform an ellipse measurement (area and circumference):” on page 82.

- 7 Select save  from the on-screen menu, or press the Enter key  to save the measurement to the patient report.



The saved measurement is shown in the upper left section of the screen, and a check mark is put in front of the measurement at the bottom of the screen.

- 8 Press the Save key  to save the image with measurements to memory. (optional)

*Note: Save the image with the measurements and calculation results before proceeding to the next calculation measurement.*





- 9 Press the Arrow keys   for the next measurement in the calculation.
- 10 Repeat these steps until all measurements have been completed.
- 11 Select calcs  from the on-screen menu to return to the list of calculations and patient report.

See “Viewing Patient Report” on page 112.

- 12 Press done  from the on-screen menu and then the Freeze key  to return to live imaging.




*Note: This must be done to turn calculations off, otherwise it remains on.*

### To view or repeat a saved measurement:

- 1 Use the Arrow keys   (next to the Enter key) to select the measurement. The previously saved measurement results will appear in the upper left section of the screen.
- 2 Repeat the measurement.  
The new results appear directly above the measurement. You can compare the active measurement to the saved measurement.
- 3 To save the new measurement, select save  from the on-screen menu, or press the Enter key .

*Note: This will save the new measurement to the patient report and overwrite the previously saved measurement.*

### To delete a measurement:

- 1 Use the Arrow keys   (next to the Enter key) to select the measurement.
- 2 Select delete  from the on-screen menu.  
This will remove the measurement from the screen and the patient report.

## Vascular Calculations

The following table shows the transducers and exam types that provide vascular calculations.

**Table 8: Transducer and Exam Types**

Transducer	Exam Type
C11	Vascular
L38	Vascular

The following table lists the available carotid vascular measurements that can be stored to the report. Vascular measurements are done in PW or CW Doppler mode.

**Table 9: Vascular Measurements**

Vascular Measurement	Description
PCCA	Proximal Common Carotid Artery
<b>MCCA</b>	<b>Mid Common Carotid Artery</b> (used in ICA/CCA ratio)
DCCA	Distal Common Carotid Artery
Bulb	Bulb
PICA	Proximal Internal Carotid Artery
<b>MICA</b>	<b>Mid Internal Carotid Artery</b> (used in ICA/CCA ratio)
DICA	Distal Internal Carotid Artery
PECA	Proximal External Carotid Artery

**Table 9: Vascular Measurements (Continued)**

Vascular Measurement	Description
MECA	Mid External Carotid Artery
DECA	Distal External Carotid Artery
VArty	Vertebral Artery

**To assign a label to a vascular measurement:**

**WARNING:**

► Verify that the patient information, date, and time settings are accurate.



**1** Select vascular exam type.

**2** On a frozen Doppler spectral trace, press the Measure key.

**3** Select calcs  from the on-screen menu.



**4** Select L or R carotid from the on-screen menu.

A list of measurement labels appear in the lower left section of the screen with the active measurement result shown directly above.


**5** Press the Arrow keys   (next to the Enter key) for the desired label for the measurement.

**6** Perform the measurement (only stores peak velocity).



*Note: End diastolic measurements cannot be saved to the patient report.*

**7** Select save  from the on-screen menu, or press the Enter key  to save the measurement to the patient report.


The saved measurement is shown in the upper left section of the screen, and a check mark is put in front of the measurement at the bottom of the screen.

**8** Press the Save key  to save the image with measurements to memory. (optional)



*Note: Save the image with the measurements and calculation results before proceeding to the next calculation measurement.*

**9** Press the Arrow keys   (next to the Enter key) for the next measurement in the calculation.

**10** Repeat these steps until all measurements have been done.



**11** Select calcs  from the on-screen menu to return to the list of calculations and patient report.

See “[Viewing Patient Report](#)” on page 112.

**12** Press done  from the on-screen menu and then the Freeze key  to return to live imaging.


*Note: This must be done to turn calculations off, otherwise it remains on.*

**To view or repeat a saved measurement:**

- 1** Use the Arrow keys ◀ ▶ (next to the Enter key) to select the measurement.  
The previously saved measurement results will appear in the upper left section of the screen.
- 2** Repeat the measurement.  
The new results appear directly above the measurement. You can compare the active measurement to the saved measurement.
- 3** To save the new measurement, select save  from the on-screen menu, or press the Enter key .

*Note: This will save the new measurement to the patient report and overwrite the previously saved measurement.*

**To delete a measurement:**

- 1** Use the Arrow keys ◀ ▶ (next to the Enter key) to select the measurement.
- 2** Select delete  from the on-screen menu.  
This will remove the measurement from the screen and the patient report.

# Cardiac Calculations

References for these measurements and calculations are located in [Chapter 8, “References”](#).

**WARNING:**

- Verify that the patient information, date, and time settings are accurate.

The following table shows the transducers and exam types that provide cardiac calculations.

**Table 10: Transducer and Exam Type**




Transducer	Exam Type (Menu shown on the system)
C15	Chest
C15 (SonoHeart)	EC1, EC2, EC3
C11	Chest

The following table shows the measurements required to complete the desired cardiac calculation. The cardiac measurements are done in 2D and M-mode.




**Table 11: Cardiac Calculations in 2D and M-mode**

Imaging Mode	Anatomy	Cardiac Measurement	Calculation Result
2D/M-mode	LV	RVWs	CO
		RVDs	EF
		IVSs	SV
		LVDs	LVESV
		LVPWs	LVEDV
		RVWd	IVSFT
		RVDd	LVPWFT
		IVSd	LVDFS
		LVDd	
		LVPWd	
		HR (in M-mode or Doppler)	
		LA/Ao	LA/Ao
		Ao	
M-mode		AoVS	AoVS
		LVET	LVET
		EF:SLOPE	EF:SLOPE
		EPSS	EPSS




### To perform cardiac calculations in 2D and M-mode:

- 1 On a frozen 2D image or M-mode trace, press the Measure key.
- 2 Select calcs  from the on-screen menu.
- 3 Select the desired cardiac calculation package from the on-screen menu.  
A list of measurements appear in the lower left section of the screen with the active measurement result shown directly above.
- 4 Press the Arrow keys   (next to the Enter key) for the desired measurement.



*Note: As you advance through the LV measurements, the top caliper will automatically reposition to help you proceed with the next selected measurement.*

- 5 Perform the cardiac measurement.
- 6 Select save  from the on-screen menu, or press the Enter key  to save the measurement to the patient report.  
The saved measurement is shown in the upper left section of the screen, and a check mark is put in front of the measurement at the bottom of the screen.
- 7 Press the Save key  to save the image with measurements to memory. (optional)

*Note: Save the image with the measurements and calculation results before proceeding to the next calculation measurement.*



- 8 Press the Arrow keys   for the next measurement in the calculation.
- 9 Repeat these steps until all measurements have been completed.
- 10 Select calcs  from the on-screen menu to return to the list of calculations and patient report.

See [“Viewing Patient Report” on page 112](#).

- 11 Press done  from the on-screen menu and then the Freeze key  to return to live imaging.


*Note: This must be done to turn calculations off, otherwise it remains on.*

**To view or repeat a saved measurement:**

- 1** Use the Arrow keys ◀ ▶ (next to the Enter key) to select the measurement.  
The previously saved measurement results will appear in the upper left section of the screen.
- 2** Repeat the measurement.  
The new results appear directly above the measurement. You can compare the active measurement to the saved measurement.
- 3** To save the new measurement, select save  from the on-screen menu, or press the Enter key .

*Note: This will save the new measurement to the patient report and overwrite the previously saved measurement.*

**To delete a measurement:**

- 1** Use the Arrow keys ◀ ▶ (next to the Enter key) to select the measurement.
- 2** Select delete  from the on-screen menu.  
This will remove the measurement from the screen and the patient report.














The following table shows the measurements required to complete the desired cardiac calculation. The cardiac measurements are done in 2D, M-mode, PW Doppler, and CW Doppler mode.

**Table 12: Cardiac Calculations in Doppler**

Anatomy	Cardiac Measurement	Calculation Result
MV (Mitral Valve)	E	E
	A	E PG
		A
		A PG
		E:A
	PHT (deceleration time)	PHT
		MVA
	dP:dT	dP:dT
LVOT (Left Ventricular Outflow Tract)	VTI	VTI
		Vmax
		PGmax
		Vmean
		PGmean
	Vmax or VTI	Vmax
		PGmax
AV (Aortic Valve)	VTI	VTI
		Vmax
		PGmax
		Vmean
		PGmean
	LVOT D in 2D	AVA
	VTI or Vmax from LVOT	
	VTI or Vmax from aorta	
	VTI	SV
	LVOT D in 2D	
	VTI	CO
	HR	
	LVOT D in 2D	
TV (Tricuspid Valve)	Vmax	Vmax
		PGmax
	dP:dT	dP:dT
PV (Pulmonic Valve)	VTI	VTI
		Vmax
		PGmax
		Vmean
		PGmean
	Vmax or VTI	Vmax
		PGmax

### To perform E, A, and Vmax measurements for PW or CW Doppler calculations:


See [Table 12, “Cardiac Calculations in Doppler,” on page 104](#) for the measurements required for the cardiac calculation.








- 1 On a frozen Doppler spectral trace, press the Measure key.
- 2 Select calcs  from the on-screen menu.
- 3 Select MV, LVOT, AV, TV, or PV from the on-screen menu.  
A list of measurements appear in the lower left section of the screen with the active measurement result shown directly above.
- 4 Press the Arrow keys   (next to the Enter key) to select the desired peak velocity calculation.
- 5 Perform the velocity measurement.
- 6 Select save  from the on-screen menu, or press the Enter key  to save the measurement to the patient report.  
The saved measurement is shown in the upper left section of the screen, and a check mark is put in front of the measurement at the bottom of the screen.
- 7 Press the Save key  to save the image with measurements to memory. (optional)  
*Note: Save the image with the measurements and calculation results before proceeding to the next calculation measurement.*
- 8 Press the Arrow keys   for the next measurement in the calculation, if needed.
- 9 Select calcs  from the on-screen menu to return to the list of calculations and patient report.  
See [“Viewing Patient Report” on page 112](#).
- 10 Press done  from the on-screen menu and then the Freeze key  to return to live imaging.

*Note: This must be done to turn calculations off, otherwise it remains on.*

### To perform a velocity time integral (VTI) calculation in PW or CW Doppler:

*Note: In addition to VTI results, this calculation will compute other results. See [Table 12, “Cardiac Calculations in Doppler,” on page 104](#).*






- 1 On a frozen Doppler spectral trace, press the Measure key.
- 2 Select calcs  from the on-screen menu.


- 3 Select LVOT, AV, or PV from the on-screen menu.  
A list of measurements appear in the lower left section of the screen with the active measurement result shown directly above.
- 4 Press the Arrow keys   to select VTI.
- 5 Perform automatic or manual trace.  
See [“To perform a manual trace in PW or CW Doppler:” on page 88](#) or [“To perform an automatic trace in PW or CW Doppler:” on page 88](#).
- 6 Select save  from the on-screen menu, or press the Enter key  to save the measurement to the patient report.  
The saved measurement is shown in the upper left section of the screen, and a check mark is put in front of the measurement at the bottom of the screen.
- 7 Select calcs  from the on-screen menu to return to the list of calculations and the patient report.  
See [“Viewing Patient Report” on page 112](#).
- 8 Press done  from the on-screen menu and then the Freeze key  to return to live imaging.

*Note: This must be done to turn calculations off, otherwise it remains on.*



### **To perform a pressure half time (PHT) calculation in PW or CW Doppler:**

*Note: PHT is calculated by measuring deceleration time from peak to baseline.*

- 1 On a frozen Doppler spectral trace, press the Measure key.
- 2 Select calcs  from the on-screen menu.
- 3 Select MV from the on-screen menu.  
A list of measurements appear in the lower left section of the screen with the active measurement result shown directly above.
- 4 Press the Arrow keys   (next to the Enter key) to select PHT.
- 5 Use the trackball to position the first caliper at the peak.
- 6 Press the Select key.  
A second caliper appears on the screen.
- 7 Use the trackball to position the second caliper along the EF slope.
- 8 Select save  from the on-screen menu, or press the Enter key  to save the measurement to the patient report.  
The saved measurement is shown in the upper left section of the screen, and a check mark is put in front of the measurement at the bottom of the screen.

- 9 Select calcs  from the on-screen menu to return to the list of calculations and the patient report.









See “Viewing Patient Report” on page 112.

- 10 Press done  from the on-screen menu and then the Freeze key  to return to live imaging.

*Note: This must be done to turn calculations off, otherwise it remains on.*

### To perform a delta pressure:delta time (dP:dT) calculation in PW or CW Doppler:

*Note: To perform the dP:dT measurements, the Doppler scale must include velocities of 300 cm/s or greater on the negative side of the baseline.*







- 1 On a frozen Doppler trace, press the Measure key.
- 2 Select calcs  from the on-screen menu.
- 3 Select MV or TV from the on-screen menu.  
A list of measurements appear in the lower left section of the screen with the active measurement result shown directly above.
- 4 Press the Arrow keys   (next to the Enter key) to select dP:dT.  
A horizontal dotted line with an active caliper appears at 100 cm/s.
- 5 Use the trackball to position the first caliper along the beginning of the wave form at 100 cm/s.
- 6 Press the Select key.  
A second horizontal dotted line with an active caliper appears at 300 cm/s.
- 7 Use the trackball to position the second caliper along the beginning of the wave form at 300 cm/s.
- 8 Select save  from the on-screen menu, or press the Enter key  to save the measurement to the patient report.  
The saved measurement is shown in the upper left section of the screen, and a check mark is put in front of the measurement at the bottom of the screen.
- 9 Select calcs  from the on-screen menu to return to the list of calculations and the patient report.  
See “Viewing Patient Report” on page 112.
- 10 Press done  from the on-screen menu and then the Freeze key  to return to live imaging.

*Note: This must be done to turn calculations off, otherwise it remains on.*

## To perform aortic valve area (AVA) calculation in PW or CW Doppler:









*Note: This calculation requires a measurement taken in 2D and two measurements taken in Doppler. After the three measurements are completed and saved, the results appear in the patient report.*

### 2D measurement:

- 1 On a frozen 2D image, press the Measure key.
- 2 Select calcs  from the on-screen menu.
- 3 Select LVOT from the on-screen menu.
- 4 Perform the measurement.
- 5 Select save  from the on-screen menu, or press the Enter key  to save the measurement to the patient report.
- 6 Select calcs  from the on-screen menu to return to the list of calculations and the patient report.
- 7 Press done  from the on-screen menu and then the Freeze key  to return to live imaging.




*Note: This must be done to turn calculations off, otherwise it remains on.*

### Doppler measurement from LVOT:




- 1 On a frozen Doppler spectral trace, press the Measure key.
- 2 Select calcs  from the on-screen menu.
- 3 Select LVOT from the on-screen menu.  
A list of measurements appear in the lower left section of the screen with the active measurement result shown directly above.
- 4 Press the Arrow keys   (next to the Enter key) to select VTI or Vmax.
- 5 Perform the measurement.  
See “To perform a manual trace in PW or CW Doppler:” on page 88 or “To perform an automatic trace in PW or CW Doppler:” on page 88.
- 6 Select save  from the on-screen menu, or press the Enter key  to save the measurement to the patient report.
- 7 Select calcs  from the on-screen menu to return to the list of calculations and the patient report.
- 8 Press done  from the on-screen menu and then the Freeze key  to return to live imaging.

*Note: This must be done to turn calculations off, otherwise it remains on.*



### **Doppler measurement from aorta:**

- 1 On a frozen Doppler spectral trace, press the Measure key.
- 2 Select calcs  from the on-screen menu.
- 3 Select AV from on-screen menu.
- 4 Press the Arrow keys   (next to the Enter key) to select VTI or Vmax.
- 5 Perform the measurement for a VTI or Vmax.

See [“To perform a manual trace in PW or CW Doppler:” on page 88](#) or [“To perform an automatic trace in PW or CW Doppler:” on page 88](#).

- 6 Select save  from the on-screen menu, or press the Enter key  to save the measurement to the patient report.
- 7 Select calcs  from the on-screen menu to return to the list of calculations and the patient report.

After the three calculations are completed and saved, the AVA calculation results will appear on the patient report. See [“Viewing Patient Report” on page 112](#).







- 8 Press done  from the on-screen menu and then the Freeze key  to return to live imaging.

*Note: This must be done to turn calculations off, otherwise it remains on.*

### **To perform stroke volume (SV) calculation in PW or CW Doppler:**







*Note: This calculation requires a measurement taken in 2D and one measurement taken in Doppler. After the measurements are completed and saved, the results appear in the patient report.*

#### **2D measurement from LVOT:**

- 1 On a frozen 2D image, press the Measure key.
- 2 Select calcs  from the on-screen menu.
- 3 Select LVOT from the on-screen menu.
- 4 Perform the measurement.
- 5 Select save  from the on-screen menu, or press the Enter key  to save the measurement to the patient report.
- 6 Select calcs  from the on-screen menu to return to the list of calculations and the patient report.
- 7 Press done  from the on-screen menu and then the Freeze key  to return to live imaging.

*Note: This must be done to turn calculations off, otherwise it remains on.*


### ***Doppler measurement from the aorta:***

- 1** On a frozen Doppler spectral trace, press the Measure key.
- 2** Select calcs  from the on-screen menu.
- 3** Select AV from the on-screen menu.
- 4** Perform the VTI measurement.  
See [“To perform a manual trace in PW or CW Doppler:” on page 88](#) or [“To perform an automatic trace in PW or CW Doppler:” on page 88](#).
- 5** Select save  from the on-screen menu, or press the Enter key  to save the measurement to the patient report.
- 6** Select calcs  from the on-screen menu to return to the list of calculations and the patient report.  
After the two calculations are completed and saved, the SV calculation result will appear on the patient report. See [“Viewing Patient Report” on page 112](#).
- 7** Press done  from the on-screen menu and then the Freeze key  to return to live imaging.

*Note: This must be done to turn calculations off, otherwise it remains on.*









### **To perform cardiac output (CO) calculation in PW or CW Doppler:**

*Note: This calculation requires a stroke volume and a heart rate. After the measurements are completed and saved, the results appear in the patient report.*

- 1** On a frozen Doppler spectral trace, press the Measure key.
- 2** Select calcs  from the on-screen menu.
- 3** Perform the calculation for SV.  
See [“To perform stroke volume \(SV\) calculation in PW or CW Doppler:” on page 109](#).
- 4** Perform the calculation for HR.  
See [“To measure a heart rate \(HR\) in PW or CW Doppler:” on page 111](#).  
After the two calculations are completed and saved, the CO will show on the patient report. See [“Viewing Patient Report” on page 112](#).



### To measure a heart rate (HR) in PW or CW Doppler:

*Note: Heart Rate can also be taken in M-mode. “To measure heart rate:” on page 84.*



- 1 On a frozen Doppler spectral trace, press the Measure key.
- 2 Select calcs  from the on-screen menu.
- 3 Select desired cardiac calculation package from the on-screen menu.  
Heart Rate is available in all cardiac packages.  
A list of measurements appear in the lower left section of the screen with the active measurement result shown directly above.
- 4 Press the Arrow keys   (next to the Enter key) to select HR.
- 5 Use the trackball to position the first vertical caliper at the beginning of the wave form.
- 6 Press the Select key.  
A second vertical caliper appears on the screen.
- 7 Use the trackball to position the second vertical caliper at the beginning of the next wave form.
- 8 Select save  from the on-screen menu, or press the Enter key  to save the measurement to the patient report.  
The saved measurement is shown in the upper left section of the screen, and a check mark is put in front of the measurement at the bottom of the screen.
- 9 Select calcs  from the on-screen menu to return to the list of calculations and the patient report.  
See “Viewing Patient Report” on page 112.
- 10 Press done  from the on-screen menu and then the Freeze key  to return to live imaging.

*Note: This must be done to turn calculations off, otherwise it remains on.*

### To view or repeat a saved measurement:




- 1 Use the Arrow keys   (next to the Enter key) to select the measurement.  
The previously saved measurement results will appear in the upper left section of the screen.
- 2 Repeat the measurement.  
The new results appear directly above the measurement. You can compare the active measurement to the saved measurement.




- 3 To save the new measurement, select save  from the on-screen menu, or press the Enter key .

*Note: This will save the new measurement to the patient report and overwrite the previously saved measurement.*




#### **To delete a measurement:**

- 1 Use the Arrow keys   (next to the Enter key) to select the measurement.
- 2 Select delete  from the on-screen menu.  
This will remove the measurement from the screen and the patient report.

## **Viewing Patient Report**

*Note: You may view the patient report using two options. If you access the patient report by selecting calc  from the on-screen menu, you will return to the frozen image. If you access the patient report by pressing the Patient key you will return to live imaging.*

#### **To view the patient report:**

- 1 Press the Patient key or, if available, select calcs  from the on-screen menu.
- 2 Select patient report from the on-screen menu.
- 3 Select forward  or back  from the on-screen menu to navigate to additional report pages, if needed.

The current page number and total number of pages in the report are displayed in the lower left section of the screen.

- 4 Select done  from the on-screen menu until you return to the image.

*Note: The pound sign symbol (####) is displayed on the patient report when an entry is not valid, e.g., value is too large or small.*

*Note: The value for a calculation only appears when the calculation has been performed.*

# Chapter 6: Troubleshooting and Maintenance

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## Troubleshooting

If you encounter difficulty with the system, use the information in this chapter to help correct the problem. If the problem is not covered here, call SonoSite technical support at the following numbers or addresses:

USA/Canada Customers

- Technical support: **1-877-657-8118**
- Technical support fax and email: **1-425-951-6700**; [service@sonosite.com](mailto:service@sonosite.com)
- SonoSite website: [www.sonosite.com](http://www.sonosite.com)

International Customers

- Call your local representative or **1-425-951-1330**.

**Table 1: Troubleshooting Symptom and Solution**

Symptom	Solution
System will not power on.	Check all power connections. Perform the following sequence: remove DC input connector and battery; wait 10 seconds; connect DC input or install battery; press the power switch. Ensure the battery is charged.
System image quality is poor.	Adjust the LCD screen to improve viewing angle. Adjust the brightness, as necessary, to improve image quality. Adjust the contrast, as necessary, to improve image quality. Adjust the gain.
Zoom does not work.	Press <b>Freeze</b> . Zoom does not work when the image is frozen.
No CPD image.	Adjust the gain.
No DCPD image.	Adjust the gain.
No OB measurement selections.	Select the OB or Gyn exam type.
No cardiac measurement selection.	Select the EC1, EC2, EC3, or Che exam type.
Thermal index is not displayed.	System transducer and imaging mode does not exceed 1.0 TI or MI, thermal index is not required.
Caliper line is not displayed.	Set the caliper line in system setup.

**Table 1: Troubleshooting Symptom and Solution (Continued)**

Symptom	Solution
Pictographs do not work.	Set pictographs in system setup.
Print does not work.	Set the correct printer in system setup. Check the printer connections. Check the printer to ensure that it is turned on and setup properly. See the printer manufacturer's instructions, if necessary.
VCR does not record.	Check the video format setting in system setups, including Print/VCR key setting Check the VCR connections. Check the VCR to ensure that it is turned on and setup properly. See the VCR manufacturers' instructions, if necessary.
External monitor does not work.	Check the video format setting in system setup. Check the monitor connections. Check the monitor to ensure that it is turned on and setup properly. See the monitor manufacturers' instructions, if necessary.
Unexpected labels using the function keys.	Ensure labels have been assigned to the function keys.
Inaccurate fetal age calculation.	Ensure that the patient information, date, and time are set accurately.
System does not recognize the transducer.	Disconnect and reconnect the transducer.
Text cursor does not move when trackball or arrows are selected.	Text cursor is constrained to one line.
A maintenance icon displays on the system screen.	This icon indicates that system maintenance is required, record the number on the C: line in parentheses and call your SonoSite representative.
ALI DICOM system will not read the English character set for date, patient name, and patient identification.	Ensure that the OCR feature is setup properly in System Setup.

## Maintenance

Use these recommendations when cleaning or disinfecting your ultrasound system, transducers, and accessories. This chapter is intended to assist in effective cleaning and disinfection. It is also intended to protect the system and transducers against damage during cleaning or disinfection.

Use the cleaning recommendations in the peripheral manufacturer's instructions when cleaning or disinfecting your peripherals.

For more information about cleaning or disinfection solutions or ultrasound gels used with the transducer, call SonoSite or your local representative. For information about a specific product, call the product manufacturer.

## Recommended Disinfectant

See the [Table 2, “Disinfectants Compatibility with SonoSite Systems and Transducers,”](#) on page 120.

## Safety

Please observe the following warnings and cautions when using cleaners, disinfectants, and gels. More specific warnings and cautions are included in the product literature and in the procedures later in this chapter.

### **WARNINGS:**

- ▶ The level of disinfection required for a device is dictated by the type of tissue it will contact during use. Ensure the disinfectant type is appropriate for the type of transducer and application. For information, see the disinfectant label instructions and the recommendations of the Association for Professionals in Infection Control and Epidemiology (APIC) and FDA.
- ▶ Most transducers cannot be sterilized. When sterility is required, use a sterile transducer cover.
- ▶ The use of sterile transducer covers and sterile coupling gel is recommended for clinical applications of all intracavitary transducers. Do not apply the transducer cover and gel until you are ready to perform the procedure.

### **CAUTIONS:**

- ▶ Do not allow disinfectant to contact metal surfaces. Use a soft cloth lightly dampened in a mild soap or compatible cleaning solution to remove any disinfectant that remains on metal surfaces.
- ▶ Repeated, long-term exposure to coupling gel can damage transducers.
- ▶ Transducer covers can contain natural rubber latex, which may cause allergic reactions in some individuals. Refer to the FDA Medical Alert-Allergenic Reactions to Latex-Containing Medical Devices, dated March 29, 1991.

## Cleaning and Disinfecting the Ultrasound System

The exterior surface of the ultrasound system and the accessories can be cleaned and disinfected using a recommended cleaner or disinfectant.

To clean the LCD video monitor, dampen a soft, cotton cloth with an ammonia-based window cleaner, and wipe the LCD video monitor clean.

### **WARNINGS:**

- ▶ To avoid electrical shock, before cleaning, disconnect the system from the power supply.
- ▶ Always use protective eyewear and gloves when cleaning and disinfecting systems.
- ▶ If a pre-mixed disinfection solution is used, observe the solution expiration date, and ensure that the date has not passed.
- ▶ The level of disinfection required for a product is dictated by the type of tissue it contacts during use. Ensure the solution strength and duration of contact are appropriate for the clinical application of the transducer. For information, see the disinfectant label instructions and the recommendations of the Association for Professionals in Infection Control and Epidemiology (APIC) and FDA.

### **CAUTIONS:**

- ▶ Do not spray cleaners or disinfectant directly on the system surfaces. Doing so may cause solution to leak into the system, damaging the system and voiding the warranty.
- ▶ Do not use strong solvents such as thinner or benzene, or abrasive cleansers, since these will damage the exterior surfaces.
- ▶ Use only recommended cleaners or disinfectants on system surfaces. Immersion-type disinfectants are not tested for use on system surfaces.
- ▶ When you clean the system, ensure the solution does not get inside the system keys, the display connections, the transducer receptacle, or the battery compartment.
- ▶ Do not scratch the LCD video monitor.

### **To clean and disinfect the system surfaces:**

- 1** Turn off the system.
- 2** Disconnect the system from the power adapter.
- 3** Use a soft cloth lightly dampened in a mild soap or detergent cleaning solution to clean exterior surfaces of the system.

- 4 Mix the disinfection solution compatible with your system according to the label instructions for the solution strength.
- 5 Wipe system surfaces with the disinfection solution, following disinfectant label instructions for solution strengths and disinfectant contact duration. Ensure the solution strength and duration of contact are appropriate for the intended clinical application.
- 6 Air dry or towel dry the system with a clean cloth according to the instructions on the disinfectant label.

## Cleaning and Disinfecting Transducers

To disinfect your transducers, you can use an immersion method or a wipe method. Immersible transducers can be disinfected only if the product labeling of the compatible disinfectant you are using indicates it can be used with an immersion method.

### **WARNINGS:**

- ▶ To avoid electrical shock, before cleaning, disconnect the transducer from the system.
- ▶ Always use protective eyewear and gloves when cleaning and disinfecting transducers.
- ▶ If a pre-mixed solution is used, observe the solution expiration date, and ensure that the date has not passed.
- ▶ The level of disinfection required for a transducer is dictated by the type of tissue it contacts during use. Ensure the solution strength and duration of contact are appropriate for the clinical application of the transducer. For information, see the disinfectant label instructions and the recommendations of the Association for Professionals in Infection Control and Epidemiology (APIC) and FDA.

### **CAUTIONS:**

- ▶ Transducers must be cleaned after every use. Cleaning transducers is necessary prior to effective disinfection. Ensure you follow the manufacturer's instructions when using disinfectants.
- ▶ Do not use a surgeon's brush when cleaning transducers. Even the use of soft brushes can damage a transducer. Use a soft cloth.

- ▶ Using a non-recommended cleaning or disinfection solution, incorrect solution strength, or immersing a transducer deeper or for a longer period of time than recommended can damage or discolor the transducer and void the transducer warranty.
- ▶ Do not immerse transducers longer than one hour. Transducers can be damaged by longer immersion times.
- ▶ Do not allow cleaning solution or disinfectant into the transducer receptacle.

#### **To clean and disinfect a transducer:**

- 1 Disconnect the transducer from the system.
- 2 Remove any transducer cover.
- 3 Use a soft cloth lightly dampened in a mild soap or compatible cleaning solution to remove any particulate matter or body fluids that remain on the transducer or cable.
- 4 To remove any remaining particulates, rinse the transducer with water.
- 5 Wipe with a dry cloth; or wipe with a water-dampened cloth to remove soap residue, and then wipe with a dry cloth.
- 6 Mix the disinfection solution compatible with your transducer, according to the label instructions for solution strength. Immerse the transducer into the disinfection solution.
- 7 Follow the instructions on the disinfectant label for the duration of the transducer immersion.

#### **WARNING:**

- ▶ Do not immerse transducers longer than one hour.
- 8 Using the instructions on the disinfectant label, rinse the transducer up to the point of immersion, and then air dry or towel dry with a clean cloth.
- 9 Examine the transducer for damage such as cracks, splitting, or fluid leaks. If damage is evident, discontinue use of the transducer, and contact SonoSite or your local representative.

## **Cleaning and Disinfecting the ECG Cables**

To disinfect your ECG cable, you can use a wipe method. The compatible disinfectants are bleach (sodium hypochlorite) and Cidex. Bleach is EPA registered and Cidex has FDA 510(k) clearance and is EPA registered.

#### **WARNING:**

- ▶ Do not sterilize the ECG cable.

For more information about disinfectant compatibility, see [Table 2, “Disinfectants Compatibility with SonoSite Systems and Transducers,”](#) on page 120.

## Sterilizable Transducers

Currently, none of the SonoSite transducers are sterilizable.

## Cleaning and Disinfecting Transducer Cables

All transducer cables can be disinfected using a recommended wipe, spray, or immersion disinfectant. Before disinfecting, however, you must orient the cable so the transducer and connector are facing up.

### **WARNING:**

- ▶ If a pre-mix solution is used, observe the solution expiration date, and ensure that the date has not passed.

### **CAUTION:**

- ▶ Attempting to disinfect a transducer cable using a method other than the one included here can damage the transducer and void the warranty.

### **To clean and disinfect the transducer cable:**

- 1** Disconnect the transducer from the system.
- 2** Remove any transducer cover.
- 3** Orient the transducer and the connector so that they are both facing up.
- 4** Use a soft cloth lightly dampened in a mild soap and detergent solution to clean the transducer cable.
- 5** Mix the disinfection solution compatible with your transducer, according to the label instructions for solution strength.
- 6** Spray or wipe the cable with the disinfection solution, following disinfectant label instructions for solution strength and duration of contact appropriate for the intended clinical use of the transducer.
- 7** Air dry or towel dry with a clean cloth according to the instructions on the disinfectant label.
- 8** Examine the transducer and cable for damage such as cracks, splitting, or fluid leaks. If damage is evident, discontinue use of the transducer, and contact SonoSite or your local representative.



**Table 2: Disinfectants Compatibility with SonoSite Systems and Transducers**

Disinfection and Cleaning Solutions	Country of Origin	Type	Active Ingredient	C60/ L38	C15/ C11	ICT	HST	System Surfaces
105 Spray	USA	Spray	Quat. Ammonia	T, C	U	N	N	U
AbcoCide (4)	USA	Liquid	Gluteraldehyde	T	U	T	U	N
AbcoCide 28 (4)	USA	Liquid	Gluteraldehyde	T	U	T	U	N
Aidal Plus	Australia	Liquid	Gluteraldehyde	U	U	U	N	U
Alkacide	France	Liquid	Gluteraldehyde	T, C	U	T, C	U	N
Alkalingettes (3)	France	Liquid	Alkylamine, Isopropanol	T, C	U	N	T, C	N
Alkaspray GSA (3)	France	Spray	Isopropyl Alcohol	U	U	U	N	U
Alkazyme	France	Liquid	Quat. Ammonia	T, C	U	N	T	N
Ampholysine Basique (3)	France	Liquid	Biguanide/Quat. Ammonia	T	U	N	T	N
Ampholysine plus	France	Liquid	Quat. Ammonia	T, C	U	N	N	N
Amphosept BV	France	Liquid	Quat. Ammonia	U	U	U	U	U
Amphospray 41(3)	France	Spray	Ethanol	T, C	U	N	N	N
Amphyl (4)	USA	Liquid	O-phenylphenol	T	U	N	N	N
Aniosyme P.L.A.	France	Liquid	Quat. Ammonia	U	U	U	N	U
Anioxyde 1000	France	Liquid	Hydrogen Peroxide Peracetic Acid	U	U	U	N	U
Ascend (4)	USA	Liquid	Quat Ammonia	U	U	U	U	A
Asepti-HB	USA	Liquid	Quat Ammonia	U	U	U	U	A
Asepti-Steryl 14 or 28 (4)	USA	Liquid	Gluteraldehyde	T, C	N	T, C	T, C	N
Asepti-Steryl	USA	Spray	Ethanol	U	U	U	U	U
Asepti-Wipes	USA	Wipes	Propanol (Isopropyl Alcohol)	U	U	U	U	A
Aseptosol	Germany	Liquid	Gluteraldehyde	N	N	N	N	N

**Table 2: Disinfectants Compatibility with SonoSite Systems and Transducers (Continued)**

Disinfection and Cleaning Solutions	Country of Origin	Type	Active Ingredient	C60/ L38	C15/ C11	ICT	HST	System Surfaces
Autoclave (Steam)		System	Steam/Heat	N	N	N	N	N
Bacillocid rasant	Germany	Liquid	Glut./Quat. Ammonia	T, C	T, C	N	N	A
Bacillol 25	Germany	Liquid	Ethanol/Propanol	T, C	U	N	N	N
Bacillol Plus	Germany	Spray	Propanol/Glut.	T, C	N	N	N	A
Bactilsine	France	Liquid	Quat. Ammonia	T, C	U	N	N	N
Baktobod	Germany	Liquid	Glut. Quat. Ammonia	T, C	U	N	N	N
Banicide (4)	USA	Liquid	Gluteraldehyde	T, C	T, C	T, C	U	N
Betadine	USA	Liquid	Providone-Iodine	N	N	N	N	N
Biotensid	Germany	Spray	2-Propanol	N	N	N	N	A
Biospray	France	Spray	Ethanol/Aldehyde	U	U	U	N	U
Bioxal M (3)	France	Liquid	Hydrogen Peroxide, Acetic Acid	U	U	U	N	U
Bleach (4)	USA	Liquid	NaCl Hypochlorite	T, C	U	N	N	N
Bodedex	France	Liquid	Quat. Ammonia	T, C	U	N	N	N
Burnishine (4)	USA	Liquid	Gluteraldehyde	T, C	U	T, C	U	N
Cavicide (4)	USA	Liquid	Isopropyl	T, C	T, C	N	N	N
Cetavlon	France	Liquid	Cetrimide	T, C	U	N	N	N
Chlorispray	France	Spray	Gluteraldehyde	T, C	U	N	N	A
Cidalkan (3)	France	Liquid	Alkylamine, isopropanol	N	N	N	N	N
Cidex (2) (4)	USA	Liquid	Gluteraldehyde	T, C	T, C	T, C	T, C	A
Cidex OPA (2) (3) (4)	USA	Liquid	ortho-phthaldehyde	T, C	T, C	T, C	T, C	A
Cidex PA (3) (4)	USA	Liquid	Hydrogen Peroxide/Pera-cetic Acid	N	N	N	N	N
Cidex Plus (2) (4)	USA	Liquid	Gluteraldehyde	T, C	T, C	T, C	T	A
Cidezyme	USA	Cleaner	Ethylene Glycol	U	U	U	N	U

**Table 2: Disinfectants Compatibility with SonoSite Systems and Transducers (Continued)**

Disinfection and Cleaning Solutions	Country of Origin	Type	Active Ingredient	C60/ L38	C15/ C11	ICT	HST	System Surfaces
Coldspor (4)	USA	Liquid	Gluteraldehyde	T, C	U	T, C	U	N
Coldspor Spray	USA	Spray	Gluteraldehyde	T, C	U	N	N	U
Control III (4)	USA	Liquid	Quat. Ammonia	T, C	T, C	N	N	N
Coverage Spray (4)	USA	Spray	Quat. Ammonia	T, C	U	N	N	A
Cutasept F	Germany	Spray	2-Propanol	T	U	N	N	A
Dialdehyde	USA	Liquid	Gluteraldehyde	U	U	U	U	U
Dismonzon pur	Germany	Liquid	Hexahydrate	T, C	T, C	N	N	A
Dispatch (4)	USA	Spray	NaCl Hypochlorite	T, C	T, C	N	N	N
End-Bac II	USA	Liquid	Quat. Ammonia	N	N	N	N	N
Endo FC	France	Liquid	Gluteraldehyde	T, C	U	T, C	T, C	N
Endo-Spore	USA	Liquid	Hydrogen Peroxide	U	U	U	U	U
Endosporine (3)	France	Liquid	Gluteraldehyde	T, C	U	T, C	U	N
Endozime AW Plus	France	Liquid	Propanol	T, C	T, C	U	N	A
Envirocide (4)	USA	Liquid	Isopropyl	T, C	T, C	N	N	N
Enzol	USA	Cleaner	Ethylene Glycol	T, C	T, C	T, C	N	A
Enzy-Clean	USA	Cleaner	Amylase/Protease Complex	U	U	U	T, C	U
Epizyme Rapid	Australia	Cleaner	Citric Acid	U	U	U	T, C	U
Esculase 388	France	Liquid	Quat. Ammonia	T, C	U	N	N	N
Ethylene Oxide (EtO) (4)		System	Ethylene Oxide	N	N	N	N	N
Expose	USA	Liquid	Isopropyl	T, C	N	N	N	N
Foam Insurance	USA	Spray	n-Alkyl	T, C	U	N	N	N
Formac	USA	Liquid	Gluteraldehyde	T, C	U	T, C	U	N
Gercid 90	France	Liquid	Quat. Ammonia	T, C	U	N	N	N
Gigasept AF (3)	Germany	Liquid	Quat. Ammonia	T, C	T, C	N	T, C	N

**Table 2: Disinfectants Compatibility with SonoSite Systems and Transducers (Continued)**

Disinfection and Cleaning Solutions	Country of Origin	Type	Active Ingredient	C60/ L38	C15/ C11	ICT	HST	System Surfaces
Gigasept FF	Germany	Liquid	Bersteinsaure	T, C	T, C	N	N	N
Glutacide	USA	Liquid	Gluteraldehyde	T, C	U	T, C	U	N
Gluteraldehyde SDS	USA	Liquid	Gluteraldehyde	U	U	U	U	U
Helipur H+N (3)	Germany	Liquid	Gluteraldehyde/ Propanol	N	N	N	N	N
Hexanios	France	Liquid	Polyhexanide/Quat. Ammonia	U	U	U	N	U
Hi Tor Plus	USA	Liquid	Chloride	T, C	T, C	N	N	N
Hibiclens	USA	Cleaner	Chlorhexidine	T, C	U	N	N	A
Hydrogen Peroxide	USA	Liquid	Hydrogen Peroxide	U	U	U	U	U
Incides	Germany	Wipe	Alcohol	N	N	N	N	U
Incidine	Germany	Spray	Aldehydes	T	U	N	N	A
Incidur	Germany	Liquid	Gluteraldehyde	U	U	U	N	U
Incidur Spray	Germany	Spray	Ethanol	N	N	N	N	N
Instruzyne	France	Liquid	Quat. Ammonia	T, C	U	N	T	N
Kawason	Australia			U	U	U	N	U
Kleen-aseptic b (4)	USA	Spray	Isopropanol	T, C	U	N	N	U
Klenzyme	USA	Cleaner	Proteolytic Enzymes	U	U	U	T	U
Kodan	Germany	Spray	Propanol/Alcohol	U	U	U	N	U
Kohrsolin ff	Germany	Liquid	Gluteraldehyde	N	N	N	T	A
Kohrsolin iD	Germany	Liquid	Gluteraldehyde	U	U	U	T	U
Korsolex (3)	Germany	Liquid	Gluteraldehyde	U	U	U	T, C	U
Korsolex basic (3)	Germany	Liquid	Gluteraldehyde	N	N	N	T, C	A
Korsolex Concentrate (3)	Germany	Liquid	Gluteraldehyde	N	N	N	N	N
Korsolex FF	Germany	Liquid	Gluteraldehyde	N	N	N	U	A

**Table 2: Disinfectants Compatibility with SonoSite Systems and Transducers (Continued)**

Disinfection and Cleaning Solutions	Country of Origin	Type	Active Ingredient	C60/ L38	C15/ C11	ICT	HST	System Surfaces
Korsolex pret a l'emploi	Germany	Liquid	Gluteraldehyde	U	U	U	T, C	U
Kutasept	Germany			U	U	U	N	U
Linget'anios	France	Towelette	Quat. Ammonia	T, C	U	N	N	N
LpHse (4)	USA	Liquid	O-phenylphenol	T, C	N	N	N	N
Lysertol V Neu (3)	Germany	Liquid	Gluteraldehyde, Formaldahyde, Quat. Ammonium chloride	T, C	U	N	T	N
Lysol IC (4)	USA	Liquid	O-phenylphenol	T, C	N	N	N	N
Madacide (4)	USA	Liquid	Isopropanol	T, C	T, C	N	N	N
Matar (4)	USA	Liquid	O-phenylphenol	T, C	T, C	N	N	N
Medi-Swab	Sweden	Wipe	Isopropyl/Alcohol	U	U	U	N	U
Medside Medallion	USA	Liquid	Quat. Ammonia	T	U	N	N	N
MetriCide (2) (4)	USA	Liquid	Gluteraldehyde	T	T	T	T	N
MetriCide 28 (2) (4)	USA	Liquid	Gluteraldehyde	T, C	N	T, C	T	N
MetriCide Plus (4)	USA	Liquid	Gluteraldehyde	T, C	T, C	T, C	U	N
Metriguard (4)	USA	Liquid	Ammonium Chloride	T, C	U	N	T	N
MetriSpray (3) (4)	USA	Spray	Gluteraldehyde	T, C	U	N	U	U
MetriZyme	USA	Cleaner	Propylene Glycol	T, C	T, C	N	U	A
Mikrobak forte	Germany	Liquid	Ammonium Chloride	T, C	T, C	N	T	A
Mikrozid Tissues (3)	Germany	Wipe	Ethanol/Propanol	N	N	N	N	A
Mikrozid	Germany	Liquid		U	U	U	U	U
Milton	Australia	Liquid	Sodium Hypochlorite	T, C	U	N	N	N
New Ger (3)	Spain	Liquid	n-Duopropenide	T, C	U	N	N	N
Nuclean	France	Spray	Alcohol/Biguanide	T, C	U	N	N	N
Omega (4)	USA	Liquid	Isopropyl	T, C	U	N	N	N
Omnicide 14NS (4)	USA	Liquid	Gluteraldehyde	T	U	T	U	N

**Table 2: Disinfectants Compatibility with SonoSite Systems and Transducers (Continued)**

Disinfection and Cleaning Solutions	Country of Origin	Type	Active Ingredient	C60/ L38	C15/ C11	ICT	HST	System Surfaces
Omnicide 28 (2) (4)	USA	Liquid	Gluteraldehyde	T, C	U	T, C	U	N
Ovation (4)	USA	Liquid	O-phenylphenol	T, C	U	N	U	N
Peract 20 (1) (2) (3)	USA	Liquid	Hydrogen Peroxide	N	N	N	N	N
Phagocide D (3)	France	Liquid	Gluteraldehyde	T, C	U	T, C	T, C	N
Phagolase ND NFLE (3)	France	Cleaner	Quaternary Ammonium, Alkylamine, Enzyme proteolytique	T, C	U	T, C	T, C	U
Phagolase pH Basique	France	Liquid	Gluteraldehyde	T, C	U	T, C	T, C	N
Phagolingette D 120 (3)	France	Towelette	Alcohol, Biguanide, Quaternary Ammonium	N	N	N	N	U
Phagosept Spray (3)	France	Spray	Alcohol, Biguanide, Quaternary Ammonium	N	N	N	N	U
Phagozyme ND (3)	France	Liquid	Quaternary Ammonium Enzymes	U	U	U	T, C	U
PowerQuat	USA	Liquid	Quat. Ammonia	T, C	U	N	N	N
Precise (4)	USA	Spray	O-phenylphenol	T, C	U	N	N	A
Presept	USA	Liquid	NaCl Dichlorite	T, C	U	N	N	N
Presept	Canada	Liquid	Gluteraldehyde	T, C	U	T, C	U	N
Pro-Cide (4)	USA	Liquid	Gluteraldehyde	T, C	U	T, C	U	N
Pro-Cide 14NS (2) (4)	USA	Liquid	Gluteraldehyde	T, C	U	T, C	U	N
Prontocid N (3)	Germany	Liquid	Formaldahyde/ Gluteraldehyde	N	N	N	N	N
Pyobactene	France	Liquid	Aldehydes	T, C	U	N	N	N
Pyosynthene EA 20	France	Liquid	Formaldahyde	T, C	U	N	U	N
Rivascop	France	Liquid	Quat. Ammonia	T, C	U	N	N	N

**Table 2: Disinfectants Compatibility with SonoSite Systems and Transducers (Continued)**

Disinfection and Cleaning Solutions	Country of Origin	Type	Active Ingredient	C60/ L38	C15/ C11	ICT	HST	System Surfaces
Ruthless	USA	Spray	Quat. Ammonia	N	N	N	N	A
Sagrosept	Germany	Liquid	Propanol	N	N	N	N	N
Sagrosept	Germany	Wipe	Propanol	T, C	N	N	U	U
Salvanios pH 10	France	Liquid	Quat. Ammonia	T, C	U	N	T, C	N
Sani-Cloth (4)	USA	Wipe	Quat. Ammonia	T, C	U	N	N	A
Sani-Cloth Plus	USA	Wipe	Quat. Ammonia	U	U	U	U	U
SDS 14NS (4)	USA	Liquid	Gluteraldehyde	T, C	U	T, C	U	N
SDS 28 (4)	USA	Liquid	Gluteraldehyde	T, C	U	T, C	U	N
Seku Extra	Germany	Liquid	Gluteraldehyde	U	U	U	T	U
Sekucid	France	Liquid	Gluteraldehyde	T, C	U	T, C	T, C	N
Sekucid N (3)	France	Liquid	Gluteraldehyde	T, C	U	T, C	T, C	N
Sekulyse	France	Liquid	Biguanide	T, C	U	N	T	N
Sekusept	Germany	Liquid	Gluteraldehyde	U	U	U	U	U
Sekusept Extra	Germany	Liquid	Glyoxal/Glut.	T, C	T, C	N	N	N
Sekusept Extra N	Germany	Liquid	Gluteraldehyde	T, C	T, C	T, C	U	N
Sekusept forte	Germany	Liquid	Formaldahyde	T, C	T, C	N	N	N
Sekusept forte S	Germany	Liquid	Formaldehyde/ Glyoxal/ Gluteraldehyde/ Quat. Ammonia	U	U	U	N	U
Sekusept Plus	Germany	Liquid	Glucoprotamin	T, C	T, C	N	N	N
Sekusept Pulver	Germany	Liquid	Natriumperborat	T, C	U	N	N	N
Sklar (4)	USA	Liquid	Isopropanol	T, C	T, C	N	N	N
Softasept N	Germany	Spray	Ethanol	N	N	N	N	A
Sporadyne	France	Liquid	Didecyldimethyl	T, C	U	N	T	N
Sporadyne pret a l'emploi (3)	France	Liquid	Gluteraldehyde	U	U	U	T	U

**Table 2: Disinfectants Compatibility with SonoSite Systems and Transducers (Continued)**

Disinfection and Cleaning Solutions	Country of Origin	Type	Active Ingredient	C60/ L38	C15/ C11	ICT	HST	System Surfaces
Sporicidin (2) (4)	USA	Liquid	Phenol	T, C	T, C	N	N	U
Sporicidin (4)	USA	Wipes	Phenol	T, C	T, C	N	N	A
Sporicidin Sterilant (2)	USA	Liquid	Phenol, Sodium Phenate, Glute.	U	U	U	T, C	U
Sporox II (4)	USA	Liquid	Hydrogen Peroxide	T, C	U	T, C	T, C	N
Staphene (4)	USA	Spray	Ethanol	T, C	N	N	N	N
Steranios	France	Liquid	Gluteraldehyde	U	U	U	N	U
STERIS (4)	USA	Liquid	Peracetic Acid	N	N	N	N	N
Surfaces Hautes (3)	France	Spray	Quat. Ammonia	T, C	U	N	N	A
Surg L Kleen	USA	Liquid		U	U	U	N	U
T-Spray	USA	Spray	Quat. Ammonia	T, C	U	N	N	A
T-Spray II	USA	Spray	Alkyl/Chloride	T	U	N	N	A
TBQ (4)	USA	Liquid	Alkyl	T, C	T, C	N	N	N
Theracide	USA	Liquid	Quat. Ammonia	T, C	T, C	N	N	N
Theracide	USA	Wipe	Quat. Ammonia	T, C	T, C	N	N	A
Thericide Plus	USA	Liquid	Quat. Ammonia	T, C	U	N	N	N
Tor (4)	USA	Liquid	Quat. Ammonia	T, C	T, C	N	N	N
Transeptic	USA	Cleaner	Alcohol	T	N	T	N	A
Ultra Swipes	USA	Wipe	Ethanol	T, C	U	N	N	U
Vaposeptol	Germany	Spray	Biguanide	T, C	U	N	T	N
Vesphene II (4)	USA	Liquid	Sodium/ o-Phenylphenate	T, C	T, C	N	N	N
Vespire (4)	USA	Liquid	Gluteraldehyde	T, C	U	T, C	U	N
Virex (4)	USA	Liquid	Quat. Ammonia	T, C	U	N	N	N
Virkon	Australia	Liquid	Potassium Monopersulfate	U	U	U	N	U



**Table 2: Disinfectants Compatibility with SonoSite Systems and Transducers (Continued)**

Disinfection and Cleaning Solutions	Country of Origin	Type	Active Ingredient	C60/ L38	C15/ C11	ICT	HST	System Surfaces
VP 483	Germany	Liquid		U	U	U	N	U
VP 483/2H	Germany	Liquid		U	U	U	N	U
Wavicide -01 (2) (4)	USA	Liquid	Gluteraldehyde	T, C	T, C	T, C	N	N
Wavicide -06 (4)	USA	Liquid	Gluteraldehyde	T, C	N	T, C	N	N
Wex-Cide (4)	USA	Liquid	O-phenylphenol	T, C	T, C	N	N	N
Wipe Out	USA	Liquid	Phenol/ Gluteraldehyde	U	U	U	N	U
Ytidesinfektion Plus	Sweden	Liquid	Isopropanol	U	U	U	N	U

(1) Compatible but no EPA Registration

(2) Has FDA 510(k)

(3) Has CE Mark

(4) EPA Registered

A = acceptable for use

N = No (do not use)

T = transducer only

T, C = transducer and cable

U = Untested (do not use)

# .....Chapter 7: Specifications

## Physical Dimensions

Height: 13.3 in. (33.8 cm)

Width: 7.6 in. (19.3 cm)

Depth: 2.5 in. (6.35 cm)

Weight: 5.7 lbs. (2.59 kg) with the C60 transducer connected

## Monitor

Height: 3.1 in. (7.9 cm)

Width: 4.3 in. (10.9 cm)

Diagonal: 5 in. (12.7 cm)

Brightness control

Contrast control

## Transducers

C60/5-2 MHz 60 mm

C15/4-2 MHz 15 mm

C11/7-4 MHz 11 mm

ICT/7-4 MHz 11 mm

L38/10-5 MHz 38 mm

HST/10-5 MHz 25-mm

## Imaging Modes

2D (256 gray shades)

Color power Doppler (CPD) (64 colors)

Continuous wave (CW) Doppler

Directional color power Doppler (64 colors)

M-mode

Pulsed wave (PW) Doppler

Tissue Harmonics Imaging (THI)

## Applications

Abdominal Imaging  
Cardiac Imaging  
Gynecology and Infertility Imaging  
Interventional and Intraoperative Imaging  
Obstetrical Imaging  
Pediatric and Neonatal Imaging  
Prostate Imaging  
Superficial Imaging  
Vascular Imaging

## Display Elements

AC power	Image memory	Previous page
Arrow	Image orientation	Record (series of three)
Auto trace	Manual trace	Record pending
Baseline	Menu labels	Show calculations
Battery and AC power	Measurements	Set
Battery charge level	Menu icons	Text annotation
Biopsy guidelines	Menu select	Time scale
Cine review	Messages	Transducer marker
Date and time	MI/TI	Transducer/mode (icon/text)
Depth scale	Next page	Transducers by imaging mode
Doppler scale	Optimization setting	Ultrasound image
ECG trace	Patient identification (ID)	Working (current system background task)
Exam type	Patient name	Zoom
Hide calculations	Pictographs	

## Ultrasound System Controls

Arrow	Gain (near, far, overall)	Save
Backspace	Keys	Select
Cine	Measure	Shift
Depth	Menu	Space
Enter	Menu select (context-specific)	Text/Picto
Freeze	Patient	Zoom (2X)
Function keys	Print/VCR or Print	

## Measurements and Calculations

### 2D

Area  $\text{cm}^2$  and circumference in cm  
Distance in cm  
Volume calculation in  $\text{cm}^3$

### M-mode

Distance in cm  
Time in seconds  
Heart Rate (HR) in bpm

### PW and CW Doppler Mode

Acceleration (ACC) in  $\text{cm/s}^2$   
Elapsed Time (ET) in ms  
Pressure Gradient (PGr) in mmHg  
Resistive Index (RI)  
Velocity in  $\text{cm/s}$   
Ratio of the two velocity measurements (+/ $\times$  or Systolic/Diastolic [S/D])

### Volume

Distance in cm

### Volume Flow

Distance (2D distance) in cm  
Time Average Mean (Doppler Trace) in  $\text{m/l}$

## Cardiac Calculations

### 2D Mode

Left Atrium/Aorta (LA/Ao)

Cardiac Output (CO) in l/m

Ejection Fraction (EF), percent

Fractional LVD Shortening, percent

Heart Rate (HR) in bpm

Interventricular Septum (IVS) Thickening Fraction, percent

Left Ventricle End Volumes (Teicholz) in ml

LVPW Thickening Fraction, percent

Stroke Volume Index (SV) in ml

### M-mode

Aortic Valve Cusp Separation (AoVS) in cm

Left Ventricle Ejection Time (LVET) in sec

E-F Slope in cm/s

E-Point Septal Separation (EPSS) in cm

### PW and CW Doppler

#### Mitral Valve Inflow

“A” Wave Peak Velocity (A) in cm/s

“A” Wave Peak Pressure (A PG) in mmHg

dP:dT in mmHg/s

“E” Wave Peak Velocity (E) in cm/s

“E” Wave Peak Pressure (E PG) in mmHg

E:A ratio (E:A)

Pressure Half Time (PHT) in m/sec

Mitral Valve Area (MVA) from PHT in cm<sup>2</sup>

Heart Rate (HR) in bpm

**Left Ventricle Outflow Tract**

Maximum Velocity (Vmax) in cm/s

Maximum Pressure Gradient (PGmax) in mmHG

Velocity Time Integral (VTI) in cm<sup>2</sup>

Mean Velocity on peak trace (Vmean) in cm/s

Mean Pressure Gradient (PGmean) in mmHG

Left Ventricular Outflow Track (LVOT D) diameter in cm

Left Ventricular Outflow Track Outflow area (LVOT area) in cm<sup>2</sup>

Heart Rate (HR) in bpm

**Aortic Valve**

Maximum Velocity (Vmax) in cm/s

Maximum Pressure Gradient (PGmax) in mmHG

Velocity Time Integral (VTI) in cm

Mean Velocity on peak trace (Vmean) in cm/s

Mean Pressure Gradient (PGmean) in mmHG

Aortic Valve Area (AVA) (derived from continuity equation) in cm<sup>2</sup>

Stroke Volume (SV) in ml

Cardiac Output (CO) in l/min

Heart Rate (HR) in bpm

**Tricuspid Valve Inflow**

dP:dT in mmHg/s

Maximum Velocity (Vmax) in cm/s

Maximum Pressure Gradient (PGmax) in mmHg

Heart Rate (HR) in bpm

**Pulmonic Valve**

Maximum Velocity (Vmax) cm/s

Maximum Pressure Gradient (PGmax) in mmHg

Velocity Time Integral (VTI) in cm<sup>2</sup>

Mean Velocity on peak trace (Vmean) in cm/s

Mean Pressure Gradient (PGmean) in mmHG

Heart Rate (HR) in bpm

## **Obstetrical Calculations**

Amniotic Fluid Index (AFI)  
Average Ultrasound Age (AUA)  
Estimated Date of Delivery (EDD) by Last Menstrual Period (LMP)  
Estimated Date of Delivery (EDD) by Average Ultrasound Age (AUA)  
Estimated Fetal Age  
Estimated Fetal Weight (EFW)  
Gestational Sac (GS)  
Volume

## **Fetal Tables**

Abdominal Circumference (AC)  
Antero Posterior Trunk Diameter (APTD)  
Biparietal Diameter (BPD)  
Crown Rump Length (CRL)  
Estimated Fetal Weight (EFW)  
Femur Length (FL)  
Fetal Trunk Cross-sectional Area (FTA)  
Gestational Sac (GS)  
Head Circumference (HC)  
Occipital-Frontal Diameter (OFD)  
Transverse Trunk Diameter (TTD)

## **Vascular**

### **PW and CW Doppler**

Proximal Common Carotid Artery (PCCA)  
Middle Common Carotid Artery (MCCA)  
Distal Common Carotid Artery (DCCA)  
Bulb  
Proximal Internal Carotid Artery (PICA)  
Middle Internal Carotid Artery (MICA)  
Distal Internal Carotid Artery (DICA)  
Proximal External Carotid Artery (PECA)  
Middle External Carotid Artery (MECA)  
Distal External Carotid Artery (DECA)  
Vertebral Artery (VArty)  
Ratio of MCCA to MICA ( $\text{MICA/MCCA ratio} = \text{MICA/MCCA}$ )

## Image Storage

Up to 119 images (depending on the configuration of your system)  
Cine review

## Accessories

AIUM Ultrasound Medical Safety Guidance Document  
Audio cable (RCA/RCA)  
Battery (extra)  
Basic Stand  
Basket for SiteStand  
Biopsy Guide Starter Kit for the L38/10-5 MHz linear array transducer  
Biopsy Guide Starter Kit for the ICT/7-4 MHz intracavitary transducer  
Biopsy Guide Starter Kit for the C60/5-2 MHz curved array transducer  
Biopsy Needle Guide/Sheath Replacement Kit for L38/10-5 and C60/5-2 transducers  
Bracket for VCR  
CRT Stand  
ECG cable  
Flat Panel Display for the SiteStand mobile docking station  
Grab and Go Carrying Case  
PC Direct serial cable (stereo/stereo)  
Power cord  
Power supply (extra)  
Premium carrying case  
Printer control cable  
ScanPack quick access carrier  
Serial cable  
SiteCharge dual battery charger  
SiteLink image manager system  
SitePack protective carrier pack  
SiteStand mobile docking station  
SonoKnowledge education package  
Ultrasound gel  
User Guide  
VCR control cable (stereo/stereo)  
Video cable (RCA/BNC)  
Video cable (RCA/RCA)  
Video cable (RCA/Stereo)



## Peripherals

### Medical Grade

See the manufacturer's specifications for the following peripherals.

Black-and-white printer\*

Color printer

External video monitor

Video cassette recorder

\* **Recommended sources for printer paper:** Contact Sony at **1-800-686-7669** for the name and number of the local distributor.

### Non-medical Grade (Commercial)

Digital video recording/playback product

External monitor (e.g., handheld or personal display)

Battery charger

Lithium battery

## Temperature, Pressure, and Humidity Limits

*Note: The temperature, pressure, and humidity limits apply only to the ultrasound system and transducers.*

### System Operating

10–40°C (50–104°F), 15–95% R.H.

700–1060hPa (0.7 ATM to 1.05 ATM)

### System Shipping/Storage

-35–65°C (-31–149°F), 15–95% R.H.

500–1060hPa (0.5ATM to 1.05 ATM)

### Battery Operating

10–40°C (50–104°F), 15–95% R.H.

### Battery Shipping/Storage

-20–60°C (-4–140°F), 0–95% R.H.

## **Transducers Operating**

10–40°C (50–104°F), 15–95% R.H.

## **Transducers Shipping/Storage**

-35–65°C (-31–149°F), 15–95% R.H.

## **Electrical**

System optional: 100-120/220-240 VAC, 50/60 Hz input, 16 VDC output power adapter

SiteCharge dual battery charger input voltage: 16.0 V, 2.8 A

SiteCharge dual battery charger output voltage: 12.6V, 3.0 A. (2x)

AC power adapter input: 100-120/220-240 VAC, 50/60 Hz

AC power adapter output: + 16VDC, 2.8 A

## **Battery**

6-cell, 11.1 VDC, 3.0 amp-hours, rechargeable lithium-ion battery pack

Run time: 1.5 to 4 hours, depending upon operating conditions

## **Electromechanical Safety Standards**

EN 60601-1:1990, European Norm, Medical Electrical Equipment–Part 1. General Requirements for Safety.

EN 60601-1-1:1993, European Norm, Medical Electrical Equipment–Part 1. General Requirements for Safety–Section 1-1. Collateral Standard. Safety Requirements for Medical Electrical Systems.

EN 60601-1-2:1993, European Norm, Medical Electrical Equipment. General Requirements for Safety–Collateral Standard. Electromagnetic Compatibility. Requirements and Tests.

EN 60601-2-25: 1995, European Norm, Medical Electrical Equipment–Part 2. Particular Requirements for Safety–Section 25. Specification for Electrocardiographs. The ECG cable meets safety requirements of EN 60601-2-25 for Type CF patient-applied part.

C22.2, No. 601.1:1990, Canadian Standards Association, Medical Electrical Equipment–Part 1. General Requirements for Safety.

CEI/IEC 61157:1992, International Electrotechnical Commission, Requirements for the Declaration of the Acoustic Output of Medical Diagnostic Ultrasonic Equipment.

UL 2601-1:1997, Second Edition, Underwriters Laboratories, Medical Electrical Equipment-Part 1: General Requirements for Safety.

## **EMC Standards Classification**

CISPR11:97, International Electrotechnical Commission, International Special Committee on Radio Interference. Industrial, Scientific, and Medical (ISM) Radio-Frequency Equipment Electromagnetic Disturbance Characteristics-Limits and Methods of Measurement.

The Classification for the Sonosite system, SiteStand, accessories, and peripherals when configured together is: Group 1, Class A.

## **Airborne Equipment Standards (without ECG Cable attached)**

RTCA/DO160D:1997, Radio Technical Commission for Aeronautics, Environmental Conditions and Test Procedures for Airborne Equipment, Section 21.0 Emission of Radio Frequency Energy, Category B.

## **ECG Standard**

ANSI/AAMI EC53-1995, Association for the Advancement of Medical Instrumentation, ECG Cables, and Lead Wires.

The SonoSite ultrasound system meets the requirements of this standard except Section 4.4.1 (Exposure to ethylene oxide (EO) sterilization) and Section 4.5.9 (Connector retention force). The requirement in Section 4.5.9 does not apply, because the product weighs less than seven pounds.

# .....Chapter 8: References

This section includes information about clinical measurements that can be made with the system, the accuracy of each measurement, and factors affecting measurement accuracy. Also included are clinical references for the system calculations.

## Measurement Accuracy

### Display Size

The precision with which a caliper can be placed in an image can be improved by making sure the area of interest fills as much of the screen as possible.

In 2D imaging, distance and area measurements are improved by minimizing the display depth and using the zoom function where possible.

### Caliper Placement

When making a measurement, accurate placement of the caliper is essential.

To improve caliper placement precision: adjust the display for maximum sharpness; use leading edges (closest to the transducer) or borders for start and stop points; and maintain a consistent transducer orientation for each type of measurement.

When the calipers are positioned farther apart, they get larger. When the calipers are moved closer together, they get smaller. The caliper line disappears as the calipers get closer together.

### 2D Measurements and Calculations

The measurements provided by the system do not define a specific physiological or anatomical parameter. Rather, what is provided is a measurement of a physical property such as distance for evaluation by the clinician. Measurement and analysis performance includes the accuracy of the caliper measurements and the accuracy of algorithms used to analyze the measurements. The accuracy values require that you can place the calipers over one pixel. The values do not include acoustic anomalies of the body.

The 2D linear distance measurement results are displayed in centimeters with one place past the decimal point, if the measurement is ten or greater; two places past the decimal point, if the measurement is less than ten. The 2D circumference is displayed in centimeters with one place past the decimal point and two places past the decimal point when displaying less than 10 centimeters.

The linear distance measurement components have the accuracy and range shown in the following tables:

**Table 1: 2D Measurement Accuracy and Range Table**

2D Measure Accuracy and Range	System Tolerance <sup>a</sup>	Accuracy By	Test Method <sup>b</sup>	Range (cm)
Axial Distance	< ±2% plus 1% of full scale	Acquisition	Phantom	0.1-30 cm
Lateral Distance	< ±2% plus 1% of full scale	Acquisition	Phantom	0.1-35 cm
Diagonal Distance	< ±2% plus 1% of full scale	Acquisition	Phantom	0.1-30 cm
Area <sup>c</sup>	< ±4% plus 1% of full scale	Acquisition	Phantom	0.1-1000 cm <sup>2</sup>
Circumference <sup>d</sup>	< ±3% plus 1% of full scale	Acquisition	Phantom	0.1-110 cm

- a. Full scale for distance implies the maximum depth of the image.
- b. An RMI 413a model phantom with 0.7 dB/cm-MHz attenuation was used.
- c. The area accuracy is defined using the following equation:  

$$\% \text{ tolerance} = ((1 + \text{lateral error}) * (1 + \text{axial error}) - 1) * 100 + 0.5\%.$$
- d. The circumference accuracy is defined as the greater of the lateral or axial accuracy and by the following equation:  

$$\% \text{ tolerance} = ((\text{maximum of 2 errors}) * 100) + 0.5\%.$$

**Table 2: M-mode Measurement and Calculation Accuracy and Range**

M-mode Measurement Accuracy and Range	System Tolerance	Accuracy By	Test Method	Range
Distance	< +/- 2% plus 1% of full scale <sup>a</sup>	Acquisition	Phantom <sup>b</sup>	0.01-25 cm
Time	< +/- 2% plus 1% of full scale <sup>c</sup>	Acquisition	Phantom <sup>d</sup>	0.01-9.0 sec
Heart Rate	< +/- 2% plus (Full Scale <sup>c</sup> * Heart Rate/100) %	Acquisition	Phantom <sup>d</sup>	20-300 bpm

a. Full scale for distance implies the maximum depth of the image.

b. An RMI 413a model phantom with 0.7 dB/cm-MHz attenuation was used.

c. Full scale for time implies the total time displayed on the scrolling graphic image.

d. SonoSite special test equipment was used.

**Table 3: PW and CW Doppler Mode Measurement and Calculation Accuracy and Range Table**

Doppler Mode Measurement Accuracy and Range	System Tolerance	Accuracy By	Test Method <sup>a</sup>	Range
Velocity cursor	< +/- 2% plus 1% of full scale <sup>b</sup>	Acquisition	Phantom	0.01 cm/sec-20 m/sec
Frequency cursor	< +/- 2% plus 1% of full scale <sup>b</sup>	Acquisition	Phantom	100Hz-62.5 kHz
Time	< +/- 2% plus 1% of full scale <sup>c</sup>	Acquisition	Phantom	0.01-9.0 sec

a. SonoSite special test equipment was used.

b. Full scale for frequency or velocity implies the maximum frequency or velocity magnitude, positive or negative, displayed on the scrolling graphic image.

c. Full scale for time implies the total time displayed on the scrolling graphic image.

## Sources of Measurement Errors

In general, two types of errors can be introduced into the measurement: acquisition error and algorithmic error.

### Acquisition Error

Acquisition error includes errors introduced by the ultrasound system electronics relating to signal acquisition, signal conversion, and signal processing for display. Additionally, computational and display errors are introduced by the generation of the pixel scale factor, application of that factor to the caliper positions on the screen, and the measurement display.

### Algorithmic Error

Algorithmic error is the error introduced by measurements, which are input to higher order calculations. This error is associated with floating-point versus integer-type math, which is subject to errors introduced by rounding versus truncating results for display of a given level of significant digit in the calculation.

## Terminology and Measurement Publications

Terminology and measurements comply with AIUM published standards.

## Cardiac References

### Left Atrium/Aorta (LA/Ao)

Feigenbaum, H. *Echocardiography*. Philadelphia: Lea and Febiger, 1994, p. 206, Figure 4-49.

### Acceleration (ACC) in cm/s<sup>2</sup>

Zwiebel, W.J., *Introduction to Vascular Ultrasonography*, 4th Edition, W.B. Saunders Company, 2000, p. 52.

$ACC = \text{abs}(\text{delta velocity}/\text{delta time})$

### Acceleration Time (AT) in msec

Oh, J.K., Seward, J.B., Tajik, A.J. *The Echo Manual*. 2nd Edition, Lippincott, Williams, and Wilkins, 1999, p. 219.

See [figure “Trace Calculations of the Doppler Wave Form” on page 87.](#)

### **Aortic Valve Area (AVA) by Continuity Equation in cm<sup>2</sup>**

Reynolds, Terry. *The Echocardiographer's Pocket Reference*. 2nd Edition, School of Cardiac Ultrasound, Arizona Heart Institute, 2000, pp. 383, 442.

$$A_2 = A_1 * V_1/V_2$$

where:  $A_2$  = Ao valve area

$A_1$  = LVOT area;  $V_1$  = LVOT velocity;  $V_2$  = Ao valve velocity

LVOT – left ventricular outflow tract

$$AVA (PV_{LVOT} / PV_{AO}) * CSA_{LVOT}$$

$$AVA (VTI_{LVOT} / VTI_{AO}) * CSA_{LVOT}$$

### **Cardiac Output (CO) in l/min**

Oh, J.K., Seward, J.B., Tajik, A.J. *The Echo Manual*. 2nd Edition, Lippincott, Williams, and Wilkins, 1999, p. 59.

$$CO = (SV * HR)/1000$$

where: CO = Cardiac Output

SV = Stroke Volume

HR = Heart Rate

### **Cross Sectional Area (CSA) in cm<sup>2</sup>**

Reynolds, Terry. *The Echocardiographer's Pocket Reference*. 2nd Edition, School of Cardiac Ultrasound, Arizona Heart Institute, 2000, p. 383

$$CSA = 0.785 * D^2$$

where: D = diameter of the anatomy of interest

### **Delta Pressure: Delta Time (dP:dT) in mmHg/s**

Otto, C.M., *Textbook of Clinical Echocardiography*. 2nd Edition, W.B. Saunders Company, 2000, pp. 117, 118.

32 mmHg/time interval in seconds



**E:A ratio in cm/sec**

E:A = velocity E/velocity A

**Ejection Fraction (EF), percent**

Oh, J.K., Seward, J.B., Tajik, A.J. *The Echo Manual*. 2nd Edition, Lippincott, Williams, and Wilkins, 1999, p. 40.

$$EF = ((LVEDV - LVESV) / LVEDV) * 100\%$$

where: EF = Ejection Fraction

LVEDV = Left Ventricular End Diastolic Volume

LVESV = Left Ventricular End Systolic Volume

**Elapsed Time (ET) in msec**

ET = time between velocity cursors in milliseconds

**Heart Rate (HR) in bpm**

HR = 3 digit value input by user or measured on M-mode and Doppler image in one heart cycle

**Interventricular Septum (IVS) Fractional Thickening, percent**

Laurenceau, J. L., Malergue, M.C. *The Essentials of Echocardiography*. Le Hague: Martinus Nijhoff, 1981, p. 71.

$$IVSFT = ((IVSS - IVSD) / IVSD) * 100\%$$

where: IVSS = Interventricular Septal Thickness at Systole

IVSD = Interventricular Septal Thickness at Diastole

### **Left Ventricular End Volumes (Teichholz) in ml**

Teichholz, L.E., Kreulen, T., Herman, M.V., et. al. "Problems in echocardiographic volume determinations: echocardiographic-angiographic correlations in the presence or absence of asynergy." *American Journal of Cardiology*, 1976, 37:7.

$$LVESV = (7.0 * LVDS^3)/(2.4 + LVDS)$$

where: LVESV = Left Ventricular End Systolic Volume

LVDS = Left Ventricular Dimension at Systole

$$LVEDV = (7.0/(2.4 + LVDD)) * LVDD^3$$

where: LVEDV = Left Ventricular End Diastolic Volume

LVDD = Left Ventricular Dimension at Diastole

### **Left Ventricular Dimension (LVD) Fractional Shortening, percent**

Oh, J.K., Seward, J.B., Tajik, A.J. *The Echo Manual*. Boston: Little, Brown and Company, 1994, pp. 43-44.

$$LVDFS = ((LVDD - LVDS)/LVDD) * 100\%$$

where: LDD = Left Ventricle Dimension at Diastole

LVDS = Left Ventricle Dimension at Systole

### **Left Ventricular Posterior Wall Fractional Thickening (LVPWFT), percent**

Laurenceau, J. L., Malergue, M.C. *The Essentials of Echocardiography*. Le Hague: Martinus Nijhoff, 1981, p. 71.

$$LVPWFT = ((LVPWS - LVPWD)/LVPWD) * 100\%$$

where: LVPWS = Left Ventricular Posterior Wall Thickness at Systole

LVPWD = Left Ventricular Posterior Wall Thickness at Diastole

### **Mean Velocity (Vmean) in cm/s**

Vmean = mean velocity

### **Mitral Valve Area (MVA) in cm<sup>2</sup>**

Reynolds, Terry. *The Echocardiographer's Pocket Reference*. 2nd Edition, School of Cardiac Ultrasound, Arizona Heart Institute, 2000, p. 391 and 452.

$MVA = 220/PHT$  where: PHT = pressure half time

*Note: 220 is an empirical derived constant and may not accurately predict mitral valve area in mitral prosthetic heart valves. The mitral valve area continuity equation may be utilized in mitral prosthetic heart valves to predict effective orifice area.*

### **Pressure Gradient (PGr) in mmHG**

Oh, J.K., Seward, J.B., Tajik, A.J. *The Echo Manual*. 2nd Edition, Lippincott, Williams, and Wilkins, 1999, p. 64.

$$4 * (\text{Velocity})^2$$

Peak E Pressure Gradient (E PG)

$$E PG = 4 * PE^2$$

Peak A Pressure Gradient (A PG)

$$A PG = 4 * PA^2$$

Peak Pressure Gradient (PGmax)

$$PGmax = 4 * PV^2$$

Mean Pressure Gradient (PGmean)

$$PGmean = 4 * Vmax^2$$

### **Pressure Half Time (PHT) in msec**

Reynolds, Terry. *The Echocardiographer's Pocket Reference*. 2nd Edition, School of Cardiac Ultrasound, Arizona Heart Institute, 2000, p. 391.

$PHT = DT * 0.29$  where: DT = deceleration time

### **Stroke Volume (SV) Doppler in ml**

Oh, J.K., Seward, J.B., Tajik, A.J. *The Echo Manual*. 2nd Edition, Lippincott, Williams, and Wilkins, 1999, p. 40, 59, 62.

$$SV = (CSA * VTI)$$

CSA = Cross Sectional Area of the LVOT

VTI = Velocity Time Integral of the aortic valve

### **Stroke Volume (SV) 2D and M-mode in ml**

Oh, J.K., Seward, J.B., Tajik, A.J. *The Echo Manual*. 2nd Edition, Boston: Little, Brown and Company, 1994, p. 44.

$$SV = (LVEDV - LVESV)$$

where: SV = Stroke Volume

LVEDV = End Diastolic Volume

LVESV = End Systolic Volume

### **Velocity Time Integral (VTI) in cm**

Reynolds, Terry. *The Echocardiographer's Pocket Reference*. 2nd Edition, School of Cardiac Ultrasound, Arizona Heart Institute, 2000, p. 383.

VTI = sum of abs (velocities [n])

where: Auto Trace – distance (cm) blood travels with each ejection period.

Velocities are absolute values.

## **Obstetrical References**

### **Abdominal Circumference (AC)**

Shinozuka, N. FJSUM, et al. "Standard Values of Ultrasonographic Fetal Biometry." *Japanese Journal of Medical Ultrasonics*, Vol. 23, No. 12, 1996, p. 885.

### **WARNING:**

- ▶ The gestational age calculated by your SonoSite system does not match the age in the aforementioned reference at the 20.0 cm and 30.0 cm abdominal circumference (AC) measurements. The implemented algorithm extrapolates the gestational age from the slope of the curve of all table measurements, rather than decreasing the gestational age for a larger AC measurement indicated in the referenced table. This results in the gestational age always increasing with an increase in AC.

### **Amniotic Fluid Index (AFI)**

Hadlock, F., et al. "Estimating Fetal Age: Computer-Assisted Analysis of Multiple Fetal Growth Parameters." *Radiology*, 1984, 152:497-501.

Hansmann, M., et al. "Ultrasound Diagnosis in Obstetrics and Gynecology." New York: Springer-Verlag, 1986, p. 431.

Chitty, Lyn S. et al. "Charts of Fetal Size: 3. Abdominal Measurements." *British Journal of Obstetrics and Gynaecology* 101 (February 1994): 131.

Jeng AFI Equation

Jeng, C.J., et al. "Amniotic Fluid Index Measurement with the Four Quadrant Technique During Pregnancy." *The Journal of Reproductive Medicine*, 35:7, 674-677, July 1990.

### **Anteroposterior Trunk Diameter (APTD)**

Shinozuka, N. FJSUM, et al. "Standard Values of Ultrasonographic Fetal Biometry." *Japanese Journal of Medical Ultrasonics*, Vol. 23, No. 12, 1996, p. 885.

### **Average Ultrasound Age (AUA)**

The system provides an AUA derived from the component measurements from the measurement tables.

### **Biparietal Diameter (BPD)**

Shinozuka, N. FJSUM, et al. "Standard Values of Ultrasonographic Fetal Biometry." *Japanese Journal of Medical Ultrasonics*, Vol. 23, No. 12, 1996, p. 885.

Hadlock, F., et al. "Estimating Fetal Age: Computer-Assisted Analysis of Multiple Fetal Growth Parameters." *Radiology*, 1984, 152:497-501.

Hansmann, M., et al. *Ultrasound Diagnosis in Obstetrics and Gynecology*. New York: Springer-Verlag, 1986, p. 440.

"Ultrasound in Obstetrics and Gynecology (Osaka University)," pp. 103-105, July 20, 1990.

Chitty, Lyn S. et al., "Charts of Fetal Size: 2. Head Measurements." *British Journal of Obstetrics and Gynaecology* 101 (January 1994): 43.

### **Crown Rump Length (CRL)**

Hadlock, F., et al. "Fetal Crown-Rump Length: Re-evaluation of Relation to Menstrual Age (5-18 weeks) with High-Resolution, Real-Time Ultrasound." *Radiology*, 182: 501-505, February 1992.

Hansmann, M., et al. "Ultrasound Diagnosis in Obstetrics and Gynecology." New York: Springer-Verlag, 1986, p. 439.

"Gestational Weeks and Computation Methods." *Ultrasound Imaging Diagnostics*, Vol. 12, No. 1, 1982-1, pp. 21-29 (Tokyo University).

"Ultrasound in Obstetrics and Gynecology (Osaka University)," pp. 20 and 96, July 20, 1990.

### **Estimated Date of Delivery (EDD) by Average Ultrasound Age (AUA)**

Results are displayed as month/day/year.

$$EDD = \text{current date} + (280 \text{ days} - AUA)$$

### **Estimated Date of Delivery (EDD) by Last Menstrual Period (LMP)**

The date entered into the patient information for LMP must precede the current date. The result is displayed as month/day/year.

$$EDD = LMP \text{ date} + 280 \text{ days}$$

### **Estimated Fetal Weight (EFW)**

#### **WARNING:**

- To prevent misdiagnosis, the estimated fetal weight calculated using the Hansmann equation at 20 weeks is significantly under weight, by an order of magnitude. This reported weight does match the expected result when using the Hansmann algorithm, which SonoSite has implemented in the ultrasound system. The Hansmann tables, not implemented by SonoSite, do have the accurate EFW for this fetal age.

Shinozuka, N. FJSUM, et al. "Standard Values of Ultrasonographic Fetal Biometry." *Japanese Journal of Medical Ultrasonics*, Vol. 23, No. 12, 1996.

Hadlock, F., et al. "Estimation of Fetal Weight with the Use of Head, Body, and Femur Measurements, A Prospective Study." *American Journal of Obstetrics and Gynecology*, Vol. 151, No. 3:333-337, February 1, 1985.

Hansmann, M., et al. "Ultrasound Diagnosis in Obstetrics and Gynecology." New York: Springer-Verlag, 1986, p. 154.

"Ultrasound in Obstetrics and Gynecology (Osaka University)," pp. 103-105, July 20, 1990.

### **Femur Length (FL)**

Shinozuka, N. FJSUM, et al. "Standard Values of Ultrasonographic Fetal Biometry." *Japanese Journal of Medical Ultrasonics*, Vol. 23, No. 12, 1996, p. 886.

Hadlock, F., et al. "Estimating Fetal Age: Computer-Assisted Analysis of Multiple Fetal Growth Parameters." *Radiology*, 1984, 152: 497-501.

Hansmann, M., et al. "Ultrasound Diagnosis in Obstetrics and Gynecology." New York: Springer-Verlag, 1986, p. 431.

"Ultrasound in Obstetrics and Gynecology (Osaka University)," pp. 103-105, July 20, 1990.

Chitty, Lyn S. et al. "Charts of Fetal Size: 4. Femur Length." *British Journal of Obstetrics and Gynaecology* 101 (February 1994): 135.

### **Fetal Trunk Cross-Sectional Area (FTA)**

"Ultrasound in Obstetrics and Gynecology (Osaka University)," pp. 103-105, July 20, 1990.

### **Gestational Sac (GS)**

Nyberg, D.A., et al. "Transvaginal Ultrasound." *Mosby Yearbook*, p. 76. 1992.

*Note: Gestational sac measurements provide a fetal age based on the mean of one, two, or three distance measurements; however, Nyberg's gestational age equation requires all three distance measurements for an accurate estimate.*

Hansmann, M., et al. "Ultrasound Diagnosis in Obstetrics and Gynecology." New York: Springer-Verlag, 1986.

"Gestational Weeks and Computation Methods." *Ultrasound Imaging Diagnostics*, Vol. 12 no. 1, 1982-1 (Tokyo University).

### **Head Circumference (HC)**

Hadlock, F., et al. "Estimating Fetal Age: Computer-Assisted Analysis of Multiple Fetal Growth Parameters." *Radiology*, 152:497-501, 1984.

Hansmann, M., et al. "Ultrasound Diagnosis in Obstetrics and Gynecology." New York: Springer-Verlag, 1986, p. 431.

Chitty, Lyn S. et al. "Charts of Fetal Size: 2. Head Measurements." *British Journal of Obstetrics and Gynaecology* 101 (January 1994): 43.

### **Occipito-Frontal Diameter (OFD)**

Hansmann, M., et al. "Ultrasound Diagnosis in Obstetrics and Gynecology." New York: Springer-Verlag, 1986, p. 431.

### **Transverse Trunk Diameter (TTD)**

Shinozuka, N. FJSUM, et al. "Standard Values of Ultrasonographic Fetal Biometry." *Japanese Journal of Medical Ultrasonics*, Vol. 23, No. 12, 1996, p. 885.

Hansmann, M., et al. "Ultrasound Diagnosis in Obstetrics and Gynecology." New York: Springer-Verlag, 1986, p. 431.

## **General References**

### **Acceleration (ACC)**

Zwiebel, W.J., *Introduction to Vascular Ultrasonography*, 4th Edition, W.B. Saunders Company, 2000, p. 52.

$ACC = \text{abs}(\Delta \text{velocity} / \Delta \text{time})$

### **Elapsed Time (ET)**

ET = time between velocity cursors in milliseconds

### **Resistive Index (RI)**

Kurtz, A.B., Middleton, W.D., *Ultrasound-the Requisites*. Mosby Year Book, Inc., 1996, p. 467.

$RI = \text{abs}((\text{Velocity A} - \text{Velocity B}) / \text{Velocity A})$  in measurements

where A = velocity cursor +

B = velocity cursor x

$RI = \text{abs}((\text{Peak Systolic Velocity} - \text{End Diastolic Velocity}) / \text{Peak Systolic Velocity})$  in manual and automatic trace

### **S/D Ratio**

Zwiebel, W.J., *Introduction to Vascular Ultrasonography*, 4th Edition, W.B. Saunders Company, 2000, p. 52.

$\text{abs}(PSV/EDV)$



**Pulsatility Index (PI)**

Kurtz, A.B., Middleton, W.D., *Ultrasound-the Requisites*. Mosby Year Book, Inc., 1996, p. 469.

$$PI = (PSV - EDV)/V$$

where: PSV = peak systolic velocity

EDV = end diastolic velocity

V = mean flow velocity throughout the entire cardiac cycle

**Time Averaged Mean (TAM) in cm/s**

TAM = mean (mean Trace)

**Volume (Vol)**

Beyer, W.H. "Standard Mathematical Tables, 28th Edition," CRC Press, Boca Raton, FL, 1987, p. 131.

**Volume Flow (VF) in l/m**

Allan, Paul L. et al. *Clinical Doppler Ultrasound*, 4th Edition, Harcourt Publishers Limited. 2000, pp. 36-38.

$$VF = CSA * TAM * .06$$

# .....Chapter 9: Glossary

This glossary includes an alphanumeric listing of all system symbols and system terms.

A “See” reference in the glossary refers you to the accepted SonoSite term. For example: rather than probe or scanhead, transducer is the accepted SonoSite term for this product.

A “See also” reference in the glossary refers you to a term that is related to this term, or provides more information about this term. For example: 2D, M-mode, PW and CW Doppler, CPD, and DCPD imaging are the system imaging modes; they are cross-referenced in this glossary to provide related information about system imaging.

The American Institute of Ultrasound in Medicine (AIUM) has published, *Recommended Ultrasound Terminology, Second Edition*, 1997. Refer to it for ultrasound terms not contained in this glossary.

## Symbols



Zoom key, which is used for turning zoom on and off during live 2D, CPD, and DCPD imaging.



Save key, which is used for saving frozen images to memory.



Print/VCR key, which is used for printing images from the system when connected to a printer or starts and stops the recording mode of the VCR when VCR-SVHS is selected.



Print key, which is used for printing images from the system when connected to a printer



Menu key, which is used for turning the on-screen menu on and off.

















Menu key (international symbol), which is used for turning the on-screen menu on and off (international devices only).



Backspace key, which deletes characters preceding the text cursor.



Text/picto key, which allows entry of text at the top-left of the image and allows display of pictograph.

	Freeze key, which stops live imaging and displays the frozen image; backs out of image review and cancels batch printing.
	Freeze key, (international symbol), which stops live imaging and displays the frozen image; backs out of image review and cancels batch printing.
	Function key, which is used with the number keys (1-6) to display assigned text; used with the “I” key to display system information. See also f key, function key assignment, and annotation.
	Depth key (international symbol), which is used to adjust the imaging depth for the 2D and M-mode images. The upper toggle decreases depth, and the lower toggle increases depth.
	Cap lock key (international symbol), which is used to lock the keyboard in capitalization mode.
	Cap lock key (international symbol, French), which is used to lock the keyboard in capitalization mode.
	Shift key (international symbol), which is used to enter capitalized characters and non-English extended characters.
	Space key (international symbol), which is used to place a space between text strings.
	Enter key (international symbol), which is used to move the cursor among fields in patient function and returns the text cursor to the top-left corner of the image area.
	Arrow keys, which are used for navigating a cursor through text annotations or listed measurements.
	Cine arrow keys, which are used for reviewing stored or frozen images.
	Print control connector, which is located on the left side of the system. The printer control cable is connected to the print control connector.
	Brightness icon.
	Contrast icon.

## Icons



Unlock icon allows you to get to the license update screen.



Next page and previous page icons indicate additional pages in the patient report.



Biopsy icon indicates that the biopsy mode is on.



Arrow icon is used to annotate images.



Icon for saved images, the number indicates how many images have been saved. The fill bar defines how full the system image storage memory is.



Menu item that returns you to the previous display.



Forward icon, which appears in menus and indicates that selecting the menu item displays another menu.



Battery icon, which appears when system is running on battery power and the AC power is not connected. When there is approximately 10 minutes of battery life remaining, the gray battery icon will flash. At 2 minutes of battery life remaining, the battery icon turns white and the system beeps.



AC power icon, which appears when the system is running on AC power and the battery is not installed.



Battery icon and AC power icon, which appears when AC power is connected and the battery is installed.



Calcs icon, which displays the measurement types and calculations available in the selected exam.



Distance caliper icon, which appears on the image and as a menu item.



Distance caliper icon, which appears on the image and as a menu item.



Ellipse caliper icon, which appears as a menu item that starts an ellipse measurement. Also toggles between the distance and ellipse measurements.



Delete menu item, which deletes a measurement and removes the measurement traces from the display or all text added to an image.



Transducer icon, which represents a transducer with M-mode turned on.



Transducer icon, which represents a transducer with PW Doppler turned on.



Transducer icon, which represents a transducer with CW Doppler turned on.



Transducer icon, which represents a transducer with CPD turned on.



Transducer icon, which represents a transducer with DCPD turned on.



List icon, which appears in menus, and indicates a list of selections.



Optimization icon, which appears in menus and indicates that selecting the menu item changes the optimization setting (see below).



Res or low, icon, which represents the resolution optimization setting in 2D. See also general and penetration.



Gen or med icon, which represents the general optimization setting in 2D and the medium optimization setting in CPD and DCPD. See also resolution and penetration.



Pen icon, which represents the penetration optimization setting in 2D. See also resolution and general.



Selection icon, which shows that there are more options for this menu item. Pressing menu select repeatedly, sequences through the options.



Maintenance icon, which indicates that system maintenance is required.



SonoSite logo. The logo appears when the system first starts up, at the top of the display, and on the SiteCharge dual battery charger.



SonoHeart logo. The logo appears at the top of the display and when the system first starts up.



Text entry icon, which indicates that a field accepts text entry.



Working icon, which indicates that the system is performing a background task.



Pictograph icon, which appears as a menu item; it is used to select the pictograph.



Print in progress icon, which indicates that an images or images are being printed.



Record in progress icon, which indicates that an image or images are being recorded.



Transducer marker, which appears on the pictograph to indicate the orientation of the transducer during the exam. This icon is moved with the trackball.



Angle correction, which appears as a menu item; it is used to turn on angle correction in PW Doppler mode.



Gate size, which appears as a menu item; it is used to adjust the gate size in PW Doppler mode.



Steering, which appears as a menu item; it is used to turn on steering in PW Doppler mode when a L38/10-5 transducer is connected to the system.



Pulse repetition frequency (or scale), which appears as a menu item in PW Doppler spectral trace mode; it is used to change the velocity scale.



Baseline, which appears as a menu item in PW Doppler spectral trace mode; it is used to change the position of the baseline.



Invert, which appears as a menu item in PW Doppler spectral trace mode; it is used to invert the image.



Wall filter, which appears as a menu item in PW Doppler spectral trace mode; it is used to change the wall filter.



Sweep speed, which appears as a menu item in M-mode and PW Doppler spectral trace mode; it is used to set the sweep speed of the trace.



Auto trace, which appears as a menu in Doppler mode.



Manual trace, which appears as a menu item in PW and CW Doppler modes.



Set, which appears as a menu item in PW and CW Doppler modes.



Set (international), which appears as a menu item in PW and CW Doppler modes.



Hide calculations, a menu item when selected removes calculations from the image.



Show calculations, a menu item when selected displays calculations on the image.



Heart rate (HR), which appears as a menu item in M-mode; it is used to measure one heart beat cycle to calculate beats per minute (bpm).



Save measurement, which appears as a menu item; it is used to save measurements to the patient report.



Tissue Harmonic Imaging (THI), which appears as a menu item.



Orientation, which appears as a menu item; it is used to change the orientation of the image being displayed.

###

Pound sign symbol (###) is displayed on the patient report when an entry is not valid, e.g., value is too large or small.

## Terms

**2D (two-dimensional) imaging:** a way to display echoes in two dimensions on a video display. Video pixels are assigned a brightness level based on echo signal amplitude. See also CPD and DCPD imaging.

**acceleration (deceleration) time:** a time period when a rate in change increases or decrease through a cardiac valve, measured in milliseconds.

**accession:** an optional 16-character field assigned to each patient file by an institution for its internal information management purposes.

**amniotic fluid index (AFI):** an OB measurement that provides a means to assess fetal status from the measurement of amniotic fluid in the maternal abdomen.

**annotations:** used to identify objects on the image display. See also f key and function key assignments.

**aortic valve area (AVA):** a calculation determined from the CSA of the LVOT and peak velocities from the LVOT and aorta, measure in  $\text{cm/sec}^2$ .

**aortic valve cusp separation (AoVS):** the distance between the trailing echo of the anterior aortic valve leaflet and the leading echo of the posterior aortic valve leaflet in early systole.

**as low as reasonably achievable (ALARA):** the guiding principle of ultrasound use, which states that you should keep patient exposure to ultrasound energy as low as reasonably achievable for diagnostic results.

**audible beep:** a menu item used to turn on or off the audible beep, which is heard after the system prints all images.

**audio, battery, date/time:** a menu item used to access audible beep, sleep delay, power delay, and date/time.

**average ultrasound age (AUA):** an estimate of the ultrasound age derived from the average of a number of fetal biometric measurements performed during an exam.

**b-mode:** see 2D imaging.

**battery:** the system uses an 11.1 volt, 3.0 amp-hour rechargeable lithium-ion battery.

**beats per minute (BPM):** the heart rate is represented in beats per minute.

**biopsy:** an icon that turns the biopsy guideline display on or off.

**biopsy guidelines:** display guidelines within the image representing the path along which a biopsy needle should pass.

**bodymarker:** see pictograph.

**brightness:** a system control used to adjust the light output of the display.



**brightness mode:** see 2D imaging.

**cable, audio:** a cable, used with the SiteStand and VCR to prove audio capability.

**cable, PC Direct:** a cable, used with the null-modem cable to connect a system directly to a PC for downloading images using SiteLink Image Manager.

**cable, printer control:** a mini-jack to mini-jack connector-type cable, 10 feet (3.1 meters) long, connects the system to a video printer.

**cable, video:** an RCA-to-BNC connector-type cable, 10 feet (3.1 meters) long, used to connect the system to an external video monitor or video printer.

**cable, video:** an RCA-to-RCA connector-type cable, 10 feet (3.1 meters) long, connects the system to an digital video recorder.

**cable, video:** an RCA-to-Stereo connector-type cable, 6 feet (1.8 meters) long, connects the system to a handheld monitor.

**cales (calculations) authors:** a menu item used to select the biometric measurement and the author from which the calculation of the ultrasound age and estimated fetal weight are derived.

**caliper:** a measurement cursor. See also cursor.

**caliper line:** a menu item used to turn on or off a line connecting two calipers, which disappears as the calipers get closer together.

**cap:** a system key used to lock the capitalization of text or labels.

**cardiac output (CO):** a cardiology calculation which appears on the patient report for the amount of blood pumped out of the heart per minute.

**case, carrying:** a protective carrying case used to carry the system, one transducer, and supplies.

**charger, SiteCharge dual battery:** a charger system used to recharge one or two system batteries.

**cine:** a series of images in image memory. When the freeze control is pressed, the cine arrow keys can be used for cine review of the images. See also cine arrow keys.

**CPD imaging:** a way to display the Doppler, time-averaged, signal amplitude or signal intensity in tissue. See also 2D and DCPD imaging.

**contrast:** a system control used to adjust the difference in light output between the light and dark parts of the display.

**control:** all system user interface devices, excluding keys, menus, receptacles. See also keys, menus, and receptacles.

**continuous wave (CW) Doppler mode:** a Doppler recording of blood flow velocities along the length of the beam.

**current patient:** a menu item used to display the current patient data. See also new patient and patient information.

**cursor:** an icon used to locate a point on the display. See also caliper.

**curved array (C60/5-2):** a transducer used for abdomen, obstetrics, and gynecology exams. It is normally identified by the letter C (curved or curvilinear) and a number (60). The number corresponds to the radius of curvature of the array expressed in millimeters. The transducer elements are electrically configured to control the characteristics and direction of the acoustic beam. See also intracavitary, linear, and microcurved transducer.

**date/time:** a menu item used to set the correct date and time.

**delete all images:** a menu item used to display a menu from which you can delete all saved images.

**delta pressure: delta time (dP:dT):** the change in pressure compared to the change in time.

**depth:** a system control used to adjust the maximum depth of the image display. A constant speed of sound of 1540 meters/second is assumed in the calculation of echo position in the image.

**depth markers:** a scale of markers along the right of the image. The small markers represent 1 centimeter (cm), the larger markers represent 5 cm.

**diameter (D):** a two-dimensional width measurement, measure in cm.

**DICOM:** Digital Imaging and Communications in Medicine

**Directional Color Power Doppler (DCPD) imaging:** a way to display the Doppler, time- averaged, signal amplitude or signal intensity in tissue to visualize the presence of detectable blood flow and the direction of blood flow. See also 2D and CPD imaging.

**display:** the viewable region of the LCD/video monitor on which the ultrasound image and other display elements appear.

**done:** a menu item used to return to the previous display or return to imaging.

**Doppler amplitude mode:** See CPD imaging.

**E:A ratio:** E velocity/A velocity, pertaining to the two peaks in a mitral valve Doppler spectrum.

**echo curve 1 (EC1) and echo curve 2 (EC2):** These two cardiac image examination types are suitable for general use to obtain a baseline image, as it displays more dynamic imaging with details on tissue characteristics. The choice between EC1 and EC2 depends on the patient body-type and the operator's preference.

**echo curve 3 (EC3):** This is a cardiac image exam, notation type setting that emphasizes image contrast.

**E-F slope:** is the rate of decay of the passive ventricular filling.

**ejection fraction (EF):** a cardiac calculation that appears in the patient report. A calculation quantifying the left ventricular systolic function, reported in a percentage.

**electrocardiogram (ECG):** a visual record the heart's electrical activity used for accurate timing of diastolic and systolic function of the heart.

**energy mode:** See CPD imaging.

**enter:** a key used to move a cursor from one field to the next.

**e-point septal separation (EPSS):** is the distance between the mitral valve E point and the posterior edge of the interventricular septum at the same point in time.

**estimated delivery date (EDD):** EDD by average ultrasound age (AUA) and by last menstrual period (LMP) date appear in the patient report, if there are corresponding measurements and an LMP from which to estimate them.

**estimated fetal age (EFA):** an estimate of the fetal age based on one or more fetal biometric measurements.

**estimated fetal weight (EFW):** an estimate of the fetal weight based on one or more fetal biometric measurements.

**exam:** a menu item used to access a list of exam types. The exam type appears in abbreviated form in the upper right section of the image display.

**exam/patient information:** a system control used to access exam type, current patient, or new patient.

**Exam type abbreviations:**

Abd: Abdomen	EC1: Echo Curve 1	Gyn: Gynecological	Pro: Prostate
Bre: Breast	EC2: Echo Curve 2	Neo: Neonatal	SmP: Small Parts
Che: Chest	EC3: Echo Curve 3	OB: Obstetrics	Vas: Vascular

**f keys:** numbered keys (1-6) with assigned text used with the function key to display text annotation.

**far:** a system control used to adjust the amplification of deeper echoes. See also gain and near.

**field:** an area on the display, usually associated with text entry or the location of a display element.

**freeze:** a system control used to stop image acquisition. Also allows you to view the current image and use the cine arrow keys to view a cine series.

**function key assignment:** a menu item used to access the list of labels assigned to each function key. See also f keys, function key, and annotations.

**gain:** an ultrasound term defined as the ratio of the output signal amplitude to the input signal amplitude. Usually expressed in decibels or as a percentage. A system control used to adjust the amplification of the echoes in the image display. See also far and near.

**general (gen):** a 2D and a DCPD imaging optimize setting. For 2D, see also penetration and resolution. For DCPD, see high.

**heart rate (HR):** the heart rate, in beats per minute, is a cardiology entry that appears on the patient report.

**hide:** a screen information setting that controls the display of the optimize setting, time, memory number, and patient information. See also show.

**high:** a CPD and DCPD imaging optimization setting. See also low and medium.

**icon:** a pictorial representation. See also pictograph and cursor.

**id:** a field into which patient identification is entered. The current patient or new patient information is available from the patient information menu item.

**image display:** the ultrasound image.

**image memory:** as images are acquired and processed, they are stored in image memory. Pressing freeze enables a cine review, which allows you to review the cine series in image memory. See also cine.

**in situ:** in the natural or original position.

**intracavitary transducer (ICT/7-4):** a transducer used for obstetrics, gynecology, and prostate exams. The transducer elements are electrically configured to control the characteristics and direction of the acoustic beam. See also curved, linear, and microcurved transducer.

**IVT (intravaginal transducer):** see intracavitary transducer.

**keyboard:** used to enter labels or individual alphanumeric characters on the display.

**last menstrual period (LMP):** the last menstrual period date entered into patient information. It is used to calculate the estimated delivery date (EDD) by LMP, which is displayed in the patient report.

**left atrium/aorta:** ratio of the left atrium and aortic root diameter.

**linear array transducer (L38/10-5):** a transducer used for small parts imaging (thyroid, testicular, musculoskeletal tissue); breast imaging; vascular imaging; and ultrasound guided procedures: line placements and biopsies. It is normally identified by the letter L (linear) and a number (38). The number corresponds to the

radius of width of the array expressed in millimeters. The transducer elements are electrically configured to control the characteristics and direction of the acoustic beam. See also curved, intracavitary, and microcurved transducer.

**low:** a CPD and DCPD imaging optimize setting. See also high and medium.

**low battery:** an icon on the right side of the display. It indicates the need to charge the system battery.

**M-mode:** Motion Mode showing the phasic motions of the cardiac structures. A single beam of ultrasound is transmitted and reflected signals are displayed as dots of varying intensities, which create lines across the screen.

**measure:** a system control used to start a measurement on the image. There are two types of measurements, distance and area.

**mechanical index (MI):** an indication of the likelihood of mechanical bioeffects occurring: the higher the MI, the greater the likelihood of mechanical bioeffects. See [Chapter 2, “Safety”](#) for a more complete description of MI.

**medium (med):** a CPD and DCPD imaging optimize setting. See also high and low.

**memory:** a menu item with two settings: show and hide. It is used to display the image memory icon.

**menu:** a list of menu items on the display. Along the left side of the display there are five controls. Pressing one of the controls, selects the menu item adjacent to the control. An ellipsis adjacent to a menu item denotes that the selection of the menu item will display another menu.

**MI/TI:** see mechanical index and thermal index.

**microcurved broadband array transducer (C15/4-2):** a transducer used for cardiology, abdominal, and thoracic imaging. It is normally identified by the letter C (curved) and a number (15). The number corresponds to the radius of curve of the array expressed in millimeters. The transducer elements are electrically configured to control the characteristics and direction of the acoustic beam. See also curved, intracavitary, and linear transducer.

**mitral valve area (MVA):** a calculation based on the pressure half time (PHT) of the area of the mitral valve in  $\text{cm/sec}^2$ .

**name:** a field into which the patient name is entered. The current patient or new patient information is available from the patient information menu item.

**near:** a system control used to adjust the amplification of shallower echoes. See also far and gain.

**neonatal microcurved broadband array transducer (C11/7-4):** a transducer used for neonatal cranium, abdomen, heart and pelvis imaging and pediatric and adult vascular access. It is normally identified by the letter C (curved) and a number (11). The number corresponds to the radius of curve of the array expressed in millimeters. The transducer elements are electrically configured to control the characteristics and direction of the acoustic beam. (See also curved, intracavitary, linear, and microconvex transducer.)

**new patient:** a menu item used to enter new patient information. Selecting new patient deletes the current patient's information and any corresponding report pages.

**NTSC (National Television Standards Committee):** a video format setting. See also PAL.

**Optical Character Recognition (OCR):** used for DICOM purposes.

**optimize:** a system control with three settings in 2D imaging: resolution, general, and penetration. It is used to adjust the 2D echo reception characteristics for body type. In CPD and DCPD imaging, there are three settings: high, medium, and low. It is used to adjust system sensitivity to high, medium, or low amplitude signals. It has two settings: show and hide. Refer to [“Transducer, Exam Type, and Imaging Mode” on page 61](#).

**orientation marker:** a marker located adjacent to the image display indicating the scan plane orientation.

**orient image:** a menu item used to select one of four image orientations. It has four settings: upper left, upper right, down left, and down right.

**PAL (phase alternating line):** a video format setting. See also NTSC.

**patient information:** a menu item used to access the current patient and new patient information. See also current patient and new patient.

**peak velocity:** a Doppler measurement of the peak velocity. E, A, and Vmax in the cardiac package are peak systolic velocity measurements.

**penetration (pen):** a 2D optimize setting. See also general and resolution.

**pictograph (picto):** (1) a menu item used to select among a set of pictographs. A pictograph is a pictorial representation of an object. Sometimes referred to as a bodymarker. (2) a system setup that turns the pictographs on or off. See also text-picto.

**power delay:** a menu item used to set the power delay to off, 15, or 30 minutes.

**power switch:** turns system power on or off. The power switch is located on the back, left of the system handle.

**pressure gradient:** a calculation for the pressure difference between two chambers of the heart, measured in mmHG.

**pressure half time (PHT):** a calculation of the mitral valve to quantify the degree of stenosis.

**printer:** a device used to print images.

**print all images:** a menu item used to print all saved images.

**probe:** see transducer.

**pulsatility index (PI):** a generic calculation of the S-D/mean.

**pulsed wave (PW) Doppler mode:** a Doppler recording of blood flow velocities in a range specific area along the length of the beam.

**resolution (res):** a 2D optimize setting. See also general and penetration.

**resistive index (RI):** a generic calculation of the S-D/S.

**review images:** a menu item used to review stored individual images.

**scanhead:** see transducer.

**select:** a system control used to set a measurement caliper, set the scan plane marker in a pictograph, and initiate other system actions.

**setting:** a value assigned to a system parameter. See also setup.

**setup:** system parameters used to customize the display and system operation. See also setting.

**shift:** a key used to enter capital letters and alternative keyboard characters.

**show:** a screen information setting that controls the display of the optimize setting, time, memory number, and patient information. See also hide.

**SiteCharge dual battery charger:** a charger system used to recharge system batteries.

**SiteStand mobile docking station:** a stand used to secure the system. It provides a mobile work platform, receptacles for using AC power and recharging the battery, a receptacle for an external video monitor, printer, and image transfer to a PC.

**skinline:** a depth on the image display that corresponds to the tissue/transducer interface.

**sleep delay:** a menu item used to set the sleep delay to off, 5, or 10 minutes.

**space:** a key used to enter a blank space on the display.

**stroke volume (SV):** a calculation for quantifying the left ventricle performance measured in ml.

**system setup:** a menu item used to access OCR, TI, picto, Doppler; screen information; audio, power, date/time; and video, printer/VCR, calcs, f keys.

**systolic/diastolic ratio (S/D ratio):** a ratio of the systolic velocity divided by the diastolic velocity.

**text/picto (pictographs):** a system control used to initiate text entry, activate a pointer, to display pictographs, and activate the biopsy guidelines (when a biopsy capable transducer is connected). The trackball is used to move the pointer and the position of the transducer marker over the pictographs. See also pictograph.

**TIB (bone thermal index):** a thermal index for applications in which the ultrasound beam passes through soft tissue and a focal region is in the immediate vicinity of bone.

**TIC (cranial bone thermal index):** a thermal index for applications in which the ultrasound beam passes through bone near the beam entrance into the body.

**TIS (soft tissue thermal index):** a thermal index related to soft tissues.

**thermal index (TI):** The ratio of total acoustic power to the acoustic power required to raise tissue temperature by 1°C under defined assumptions. See [Chapter 2, “Safety”](#) for a more complete description of TI.

**time:** a menu item with two settings: show and hide. It is used to show or hide the time display.

**time average mean (TAM):** a calculation of the mean time measured in cm/sec.

**tissue harmonic imaging (THI):** transmits at one frequency and receives at a higher harmonic frequency to reduce noise and clutter and improve resolution.

**trackball:** a system control used to move objects on the image display.

**transducer:** a device that transforms one form of energy into another form of energy. Ultrasound transducers contain piezoelectric elements, which when excited electrically, emit acoustic energy. When the acoustic energy is transmitted into the body, it travels until it encounters an interface, or change in tissue properties. At the interface, an echo is formed that returns to the transducer, where this acoustic energy is transformed into electrical energy, processed, and displayed as anatomical information. See curved, intracavitary, linear, and microcurved transducer.

**velocity time integral (VTI):** a calculation of a sum of the velocities.

**video format:** a menu item used to select NTSC or PAL. See also NTSC and PAL.

**volume:** a calculation of three, 2D measurements taken to calculate the volume of the imaged tissue or space.

**volume flow:** a calculation to quantify blood flow.



**working:** a process that describes when the system is working on a background task, such as printing.

+/ $\times$  **ratio:** a ratio of the “+” caliper over the “x” caliper.

## Acronyms

Acronym	Description
A	“A” Wave Peak Velocity
A PG	“A” Wave Peak Pressure Gradient
AC	Abdominal Circumference
ACC	Acceleration
Ao	Aorta
AFI	Amniotic Fluid Index
AoD	Aortic Root Diameter
AoVS	Aortic Valve Cusp Separation
AT	Acceleration (Deceleration) Time
APTD	Anteroposterior Trunk Diameter
AUA	Average Ultrasound Age
AV	Aortic Valve
AVA	Aortic Valve Area
BPD	Biparietal Diameter
BPM	Beats per Minute
CO	Cardiac Output
CCA	Common Carotid Artery
CPD	Color Power Doppler
CRL	Crown Rump Length
CW	Continuous Wave Doppler
D	Diameter
DCPD	Directional Color Power Doppler
dP:dT	Delta Pressure: Delta Time
E	“E” Wave Peak Velocity
E PG	“E” Wave Peak Pressure Gradient
E:A	E:A Ratio
ECG	Electrocardiogram
EDD	Estimated Delivery Date
EDD by AUA	Estimated Delivery Date by Average Ultrasound Age
EDD by LMP	Estimated Delivery Date by Last Menstrual Period
EF	Ejection Fraction
EF SLOPE	E-F Slope

Acronym	Description
EFW	Estimated Fetal Weight
EPSS	"E" Point Septal Separation
ET	Elapsed Time
FL	Femur Length
FTA	Fetal Trunk Area
GS	Gestational Sac
HC	Head Circumference
HR	Heart Rate
IVS	Interventricular Septum
IVSFT	Interventricular Septum Fractional Shortening
LA	Left Atrium
LA/Ao	Left Atrium/Aorta
LMP	Last Menstrual Period
LVD	Left Ventricular Dimension
LVDFS	Left Ventricular Dimension Fractional Shortening
LVEDV	Left Ventricular End Diastolic Volume
LVESV	Left Ventricular End Systolic Volume
LVET	Left Ventricular Ejection Time
LVOT	Left Ventricular Outflow Track
LVOT area	Left Ventricular Outflow Track Area
LVOT D	Left Ventricular Outflow Track Diameter
LVPW	Left Ventricular Posterior Wall
LVPWFT	Left Ventricular Posterior Wall Fractional Thickening
MV	Mitral Valve
MVA	Mitral Valve Area
OFD	Occipital Frontal Diameter
PGr	Pressure Gradient
PGmax	Maximum Pressure Gradient
PGmean	Mean Pressure Gradient
PHT	Pressure Half Time
PI	Pulsatility Index
PV	Pulmonic Valve
PW	Pulsed Wave Doppler
RI	Resistive Index
RVD	Right Ventricular Dimension
RVW	Right Ventricular Free Wall
S/D	Systolic/Diastolic Ratio
SV	Stroke Volume
TAM	Time Average Mean

Acronym	Description
TTD	Transverse Trunk Diameter
TV	Tricuspid Valve
Vmax	Maximum Velocity
Vmean	Mean Velocity
Vol	Volume
VF	Volume Flow
VTI	Velocity Time Integral
+/ $\times$	"+" Caliper/" $\times$ " Caliper Ratio

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